KNOWLEDGE
AN ILLUSTRATED
MAGAZINE OF SCIENCE
PLAINLY WORDED—EXACTLY DESCRIBED

LONDON: FRIDAY, OCT. 10, 1884.

CONTENTS OF No. 154.

	PAGE
The Chemistry of Cookery. XLIV. By W. Mattieu Williams	289
Flight of a Missile. (*Illus.*) By Richard A. Proctor	290
Emigrants' Prospects in Canada. (*Concluded.*) By W. R. Browne	292
The Entomology of a Pond. (*Illus.*) By E. A. Butler	293
The International Health Exhibition. XIX. (*Illus.*)	294
Notes on Coal. By R. A. Proctor.	295
Dickens's Story Left Half Told. By Thomas Foster	297
Electric Light Dangers. By W. Slingo	298
New Stern-wheel Gunboats. (*Illus.*)	299
Other Worlds than Ours. By M. de Fontenelle. With Notes by Richard A. Proctor	300
Tricycles in 1884. By J. Browning	301
Editorial Gossip	302
Reviews	303
Face of the Sky. By F.R.A.S.	303
Wolf's Comet	303
Correspondence:—The Afterglow and its Cause—Life after Death—Brain Power, &c.	304
Our Whist Column	307
Our Chess Column	308

THE CHEMISTRY OF COOKERY.

By W. Mattieu Williams.

XLIV.—THE COOKERY OF WINE (*continued*).

THE paternal tenderness with which wine is regarded, both by its producers and consumers, is amusing. They speak of it as being "sick," describe its "diseases" and their remedies as though it were a sentient being; and its diseases, like our own, are now attributed to bacilli, bacteria, or other microbia.

Pasteur, who has worked out this question of the origin of diseases in wine as he is so well known to have done in animals, recommends (in papers read before the French Academy in May and August, 1865), that these microbia be "killed" by filling the bottles close up to the cork, which is thrust in just with sufficient firmness to allow the wine on expanding to force it out a little, but not entirely, thus preventing any air from entering the bottle. The bottles are then placed in a chamber heated to temperatures ranging from 45° to 100° C. (113° to 212° Fahr.), where they remain for an hour or two. They are then set aside, allowed to cool, and the cork driven in. It is said that this treatment kills the microbia, gives to the wine an increased bouquet and improved colour—in fact, ages it considerably. Both old and new wines may be thus treated.

I simply state this on the authority of Pasteur, having made no direct experiments or observations on these diseases, which he describes as resulting in acetification, ropiness, bitterness, and decay or decomposition.

There is, however, another kind of sickness which I have studied, both experimentally and theoretically. I refer to the temporary sickness which sometimes occurs to rich wines when they are moved from one cellar to another, and to wines when newly exported from their native climate to our own. The wines that are the most subject to such sickness are those that are the most genuine—the natural, unsophisticated wines, those that have not been subjected to "fortification," to "vinage," to "plastering," "sulphuring," &c.—processes of cookery to be presently described.

This sickness shows itself by the wine becoming turbid, or opalescent, then throwing down either a crust or a loose, troublesome sediment.

Those of my readers who are sufficiently interested in this subject to care to study it practically should make the following experiment:—

Dissolve in distilled water, or, better, in water slightly acidulated with hydrochloric acid, as much cream of tartar as will saturate it. This is best done by heating the water, agitating an excess of cream of tartar in it, then allowing the water to cool, the excess of salt to subside, and pouring off the clear solution. Now add to this solution, while quite clear and bright, a little clear brandy, whisky, or other spirit, and mix them by shaking. The solution will become "sick," like the wine. Why is this?

It depends upon the fact that the bitartrate of potass, or cream of tartar, is soluble to some extent in water, but almost insoluble in alcohol. In a mixture of alcohol and water its solubility is intermediate—the more alcohol the smaller the quantity that can be held in solution (hydrochloric and most other acids, excepting tartaric, increase its solubility in water). Thus, if we have a saturated solution of this salt either in pure water or acidulated water or wine, the addition of alcohol throws some of it down in solid form, and this makes the solution sick or turbid. When pure water or acidulated water is used, as in the above-described experiment, crystals of the salt are freely formed, and fall down readily; but with a complex liquid like wine, containing saccharine and mucilaginous matter, the precipitation takes place very slowly; the particles are excessively minute, and become entangled with the mucilage, &c., and thus remain suspended for a long time, maintaining the turbidity accordingly.

Now, this bitartrate of potash is the characteristic natural salt of the grape, and its unfermented juice is saturated with it. As fermentation proceeds, and the sugar of the grape-juice is converted into alcohol, the capacity of the juice for holding the salt in solution diminishes, and it is gradually thrown down. But it does not fall alone. It carries with it some of the colouring and extractive matter of the grape-juice. This precipitate, in its crude state called *argol*, or *roher weinstein*, is the source from which we obtain the tartaric acid of commerce, the cream of tartar, and other salts of tartaric acid.

Now let us suppose that we have a natural, unsophisticated wine. It is evident that it is saturated with the tartrate, since only so much argol was thrown down during fermentation as it was unable to retain. It is further evident that if such a wine has not been exhaustively fermented, *i.e.*, still contains some of the original grape-sugar, and, if any further fermentation of this sugar takes place, the capacity of the mixture for holding the tartrate in solution becomes diminished, and a further precipitation must occur. This precipitation will come down very slowly, will consist not merely of pure crystals of cream of tartar, but of minute particles carrying with it some colouring matter, extractives, &c., and thus spoiling the brilliancy of the wine, making it more or less turbid.

But this is not all. Boiling water dissolves $\frac{1}{6}$ of its weight of cream of tartar, cold water only $\frac{1}{160}$, and, at intermediate temperatures, intermediate quantities. Therefore, if we lower the temperature of a saturated solution, precipitation occurs. Hence, the sickening of wine due to change of cellars or change of climate, even when no further fermentation occurs. The lighter the wine, *i.e.*, the less alcohol it contains naturally, the more tartrate it contains, and the greater the liability to this source of sickness.

This, then, is the temporary sickness to which I have referred. I have proved the truth of this theory by filtering such sickened wine through laboratory filtering paper, thereby rendering it transparent, and obtaining on

the paper all the guilty disturbing matter. I found it to be a kind of argol, but containing a much larger proportion of extractive and colouring matter, and a smaller proportion of tartrate than the argol of commerce. I operated upon rich new Catalan wine.

This brings me at once to the source or origin of a sort of wine-cookery by no means so legitimate as the Pasteuring already described, as it frequently amounts to serious adulteration.

The wine-merchants are here the victims of their customers, who demand an amount of transparency that is simply impossible as a permanent condition of unsophisticated grape-wine. To anybody who has any knowledge of the chemistry of wine, nothing can be more ludicrous than the antics of the pretending connoisseur of wine who holds his glass up to the light, shuts one eye (even at the stage before double vision commences), and admires the brilliancy of the liquid, this very brilliancy being, in nineteen samples out of twenty, the evidence of adulteration, cookery, or sophistication of some kind. Genuine wine made from pure grape-juice without chemical manipulation is a liquid that is never reliably clear, for the reasons above stated. Partial precipitation, sufficient to produce opalescence, is continually taking place, and therefore the brilliancy demanded is obtained by substituting the natural and wholesome tartrate by salts of mineral acids, and even by the free mineral acid itself. At one time I deemed this latter adulteration impossible, but have been convinced by direct examination of samples of *high-priced* (mark this, not *cheap*) dry sherries that they contained free sulphuric and sulphurous acid.

The action of this free mineral acid on the wine will be understood by what I have already explained concerning the solubility of the bitartrate of potash. This solubility is greatly increased by a little of such acid, and therefore the transparency of the wine is by such addition rendered stable, unaffected by changes of temperature.

But what is the effect of such mineral acid on the drinker of the wine? If he is in any degree predisposed to gout, rheumatism, stone, or any of the lithic acid diseases, his life is sacrificed, with preceding tortures of the most horrible kind. It has been stated, and probably with truth, that the late Emperor Napoleon III. drank dry sherry, and was a martyr of this kind. I repeat emphatically that high-priced dry sherries are far worse than cheap Marsala, both as regards the quantity they contain of sulphates and free acid.

Anybody who doubts this may convince himself by simply purchasing a little chloride of barium, dissolving it in distilled water, and adding to the sample of wine to be tested a few drops of this solution.

Pure wine, containing its full supply of natural tartrate, will become cloudy to a small extent, and gradually. A small precipitate will be formed by the tartrate. The wine that contains either free sulphuric acid or any of its compounds will yield *immediately* a copious white precipitate like chalk, but much more dense. This is sulphate of baryta. The experiment may be made in a common wine-glass, but better in a cylindrical test-tube, as, by using in this a fixed quantity in each experiment, a rough notion of the relative quantity of sulphate may be formed by the depth of the white layer after all has come down. To determine this *accurately*, the wine, after applying the test, should be filtered through proper filtering paper, and the precipitate and paper burnt in a platinum or porcelain crucible and then weighed; but this demands apparatus not always available, and some technical skill. The simple demonstration of the copious precipitation is instructive, and those of my readers who are practical chemists, but have not yet applied this test to such wines, will be astonished, as I was, at the amount of precipitation.

I may add that my first experience was upon a sample of dry sherry, brought to me by a friend who bought his wine of a most respectable wine-merchant, and paid a high price for it, but found that it disagreed with him; since that I have tested scores of samples, some of the finest in the market, sent to me by a thoroughly conscientious importer as the best he could obtain, and these contained sulphate of potash instead of bitartrate.

My friend, the sherry-merchant, could not account for it, though he was most anxious to do so. This was about three years ago. By dint of inquiry and cross-examination of experts in the wine trade, I have, I believe, discovered the origin of the sulphate of potash that is contained in the samples that the British wine-merchant sells as he buys, and conscientiously believes to be pure. I will state particulars in my next.

FLIGHT OF A MISSILE.

By Richard A. Proctor.

(*Continued from p.* 253.)

I PROCEED to follow the simpler course employed in dealing with the flight of a vertical missile.

If v is the velocity, ε the elevation, $v \sin \varepsilon$ the vertical velocity, then the time t_1 of ascent or of descent $= \frac{v \sin \varepsilon}{g}$;

the height attained $h = \frac{v^2 \sin^2 \varepsilon}{2g} =$ A M, Fig. 2.

The missile starts, then, from O in the real direction Op, with velocity V; and the resolved part of this velocity in direction O l (in both figs.) is V. cos p O l, or

$$\sqrt{v^2 \cos^2 \varepsilon + u^2 + 2uv \cos \varepsilon \cos \alpha}.$$

Suppose now a point to travel uniformly along O l, Fig. 2, with this velocity V cos p O l, while the body pursues its course along the path O A a starting with velocity V, and under the influence of terrestrial gravity (which, so far as this motion is concerned, may be supposed to result from the whole mass of the earth concentrated at S). Then

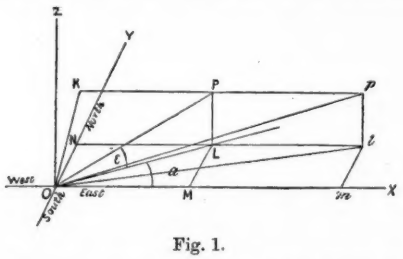


Fig. 1.

throughout these movements the missile travelling along O A a and the point travelling along O l b sweep out equal areas, and each the same area per unit of time, around S. Hence if the moving point reaches b when the missile arrives at the ground again at a, we have

$$\text{Area S O A } a = \text{sector O S } b$$

$$\therefore \text{ area O A } a \text{ M} = \text{sector S } a\ b$$

Or, appreciably, $\frac{2}{3}$ O a . A M* $= \frac{1}{2}$ S a . $a\ b$

$$\text{or } a\ b = \tfrac{4}{3} \text{ O } a \,.\, \frac{h}{r} = \tfrac{4}{3} \text{ O } b \,.\, \frac{h}{r}$$

* It is clear that, for such an area as O A a must necessarily be, the relations between a parabolic area such as O A a (A M the axis) and the enclosing rectangle, must be approximately fulfilled, the curve O A a not differing appreciably from a parabola when so small an area as O A a is taken.

approximately, because, as compared with O M a, $a\,b$ may be neglected.

Now $O\,b = 2t_1 \,.\, V \cos p\, O\, l$

$$= 2t_1 \sqrt{v^2 \cos^2 \varepsilon + u^2 + 2\,u\,v \cos \varepsilon \,.\, \cos a}$$

Hence we have

$$a\,b = \frac{4\,O\,b \,.\, h}{3\,r}$$

$$= \frac{4\,t_1}{3rg} \cdot v^2 \sin^2 \varepsilon \sqrt{v^2 \cos^2 \varepsilon + u^2 + 2\,u\,v \cos \varepsilon \cos a}$$

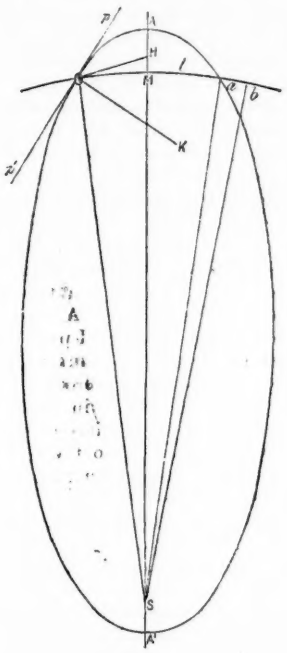


Fig. 2.

Now, in Fig. 3, let $O\,l\,a\,b$ represent the path $O\,l\,a\,b$ of Fig. 2, and let $O\,m\,X$ represent the latitude-parallel $O\,m\,X$ of Fig. 1. Put $O\,k$ to represent the distance traversed by O along this latitude-parallel, in time $2\,t_1$, owing to the earth's rotation, so that the point O is carried to k by the time the missile has descended to a. Then $k\,a$ is the real range of the body; and obviously $k\,b$ is the range calculated in the usual way, for in determining $O\,b$ we supposed the

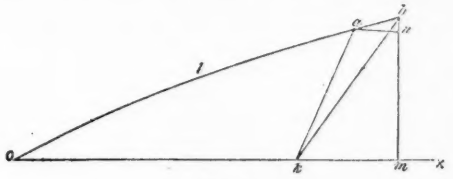


Fig. 3.

horizontal velocity constant during the time of flight. Thus, drawing $a\,n$ perpendicular to $b\,m$, we see that the point a actually reached by the missile lies south of b, the point calculated in the usual way, by the distance $b\,n$, and west of b by the distance $a\,n$.

Thus we have

Southerly displacement of the missile $= a\,b \sin l\,O\,m$ } See
Westerly displacement $= a\,b \cos l\,O\,m$ } Fig. 1

We have already obtained the value of $a\,b$; and we have

$$\sin l\,O\,m = \frac{l\,m}{O\,l} = \frac{v \cos \varepsilon \sin a}{\sqrt{v^2 \cos^2 \varepsilon + u^2 + 2\,u\,v \cos \varepsilon \cos a}}$$

$$\cos l\,O\,m = \frac{O\,m}{O\,l} = \frac{v \cos \varepsilon \cos a + u}{\sqrt{v^2 \cos^2 \varepsilon + u^2 + 2\,u\,v \cos \varepsilon \cos a}}$$

Hence we have, finally—

$$\text{S. Dispt} = b\,n = \frac{4t_1}{3rg} v^3 \sin^2 \varepsilon \cos \varepsilon \sin a$$

$$= \frac{8}{3r} t_1 h\, v \cos \varepsilon \sin a$$

$$\text{W. Dispt.} = a\,n = \frac{4t_1}{3rg} (v^3 \sin^2 \varepsilon \cos \varepsilon \cos a + u\, v^2 \sin^2 \varepsilon)$$

$$= \frac{8}{3r} t_1 h\, (v \cos \varepsilon \cos a + u).$$

A portion of the westerly displacement is independent of the angle of inclination of the plane of flight to the latitude-parallel through the point of projection, and depends only on the time of flight, the elevation, and the latitude. The last-named, we remember, is connected with u by the relation

$$u = 2\,\pi\, r \cos \lambda \div \text{no. of secs. in sidereal day.}$$

Substituting this value for u, and putting P for the number of seconds in a sidereal day, we have

$$\text{Westerly displacement} = \frac{t_1 h}{3} \left(\frac{8v \cos \varepsilon \cos a}{r} + \frac{16\pi \cos \lambda}{\mathrm{P}} \right)$$

When $\varepsilon = 90°$, or the missile is projected vertically, we have

$$\text{Westerly displacement} = \frac{16 t_1 h\, \pi \cos \lambda}{\mathrm{P}},$$

the value obtained in the first number of vol. IV.

It will be observed that both in the expression for the southerly and westerly displacements, cos ε is always positive; for ε is the angle of inclination with the horizontal line, and is always less than 90°. But a being the angle of inclination with the latitude-parallel on the eastern side of the point of projection, is measured (as angles are always measured) in the direction contrary to that in which the hands of a watch move: this angle may have any value from 0° to 360°. If a is greater than 180°, or the projectile has a southerly direction, the expression for the southerly displacement becomes negative, or the displacement is northerly. In the southern hemisphere these relations are not reversed, a projectile directed northwards from a point in the southern hemisphere having southerly displacement, while a projectile directed southwards has northerly displacement. A projectile directed vertically has no displacement in latitude.

If a is between 0° and 90°, or between 270° and 360°, in other words, if the projectile is directed towards the east (in either hemisphere), both terms of the westerly displacement are positive. But if a is between 90° and 270°, or the projectile is directed towards the west, the first term is negative. The second term is always positive. In this case the easterly displacement corresponding with the negative first term may be equal to or greater than the westerly displacement corresponding with the positive second term. The relation which should hold for these displacements to balance each other, is manifestly obtained by equating the above expression for the westerly displacement to zero, giving

$$v \cos \varepsilon \cos a = u = \frac{2\pi r}{\mathrm{P}} \cos \lambda$$

If $a = 0$, or the missile is projected at an angle ε with the horizon due west, we have

$$v \cos \varepsilon = u$$

or the horizontal resolved part of the missile's velocity westwards is equal to the velocity of the point of projection eastwards on account of the earth's rotation. In this case, and in this case only, the range of the missile is the same (apart from atmospheric resistance) as that given by the usual formula.

In order that a missile should fall exactly at the point of projection, we must have, manifestly, the northerly range (estimated by the usual formula) equal to the southerly displacement, and the easterly range equal to the westerly displacement, giving the equations

$$2t_1 v \cos\varepsilon \sin\alpha = \frac{8}{3r} t_1 h v \cos\varepsilon \sin\alpha \qquad \text{(i.)}$$

$$\text{and } 2t_1 v \cos\varepsilon \cos\alpha = \frac{8}{3r} t_1 h (v \cos\varepsilon \cos\alpha + u) \qquad \text{(ii.)}$$

(i.) is satisfied if $\varepsilon = 90°$, or if $\alpha = 0°$; or if $h = \frac{3}{4}r$

(ii.) cannot be satisfied if $\varepsilon = 90°$ or if $h = \frac{3r}{4}$. If $\alpha = 0$, (ii.) is satisfied if

$$3r \cdot v \cos\varepsilon = 4h(v \cos\varepsilon + u); \qquad \text{(iii.)}$$

which may be written in either of the forms

$$v \cos\varepsilon = \frac{4hu}{3r - 4h} \qquad \text{(iv.)}$$

$$\text{and} \qquad h = \frac{3rv \cos\varepsilon}{4(v \cos\varepsilon + u)} \qquad \text{(v.)}$$

(iv.) Shows what the horizontal velocity (east) should be if the missile is projected to a given height, h; and (v.) shows what the height should be if the missile has a given horizontal velocity (east); in order that a projectile should fall back to the place of projection.

In all cases of actual missiles or projectiles, h is very small compared with r, the earth's radius, and $v \cos\varepsilon$ is very small, compared with u; so that—

$$\text{(iv.) may be written } v \cos\varepsilon = \frac{4hu}{3r} = \frac{8\pi}{3P} h \cos\lambda \qquad \text{(vi.)}$$

$$\text{and (v.) may be written } h = \frac{3rv \cos\varepsilon}{4u} = \frac{3P}{8\pi} \cdot \frac{v \cos\varepsilon}{\cos\lambda}$$

which is the same as equation (vi.).

To illustrate the application of (vi.); suppose $h = 1{,}000$ ft., and $\lambda = 0$, or the point of projection is on the equator. Then $v \cos\varepsilon$, or the resolved part of the velocity of projection parallel to the horizon $= \frac{8000 \times 3{\cdot}1416}{3 \times 24 \times 60 \times 60}$ (using an ordinary instead of a sidereal day),

$$= \frac{251{\cdot}328}{108 \times 24} = \frac{251{\cdot}328}{2592}$$

or the horizontally resolved part of the velocity of projection is less than the 10th of a foot per second. The velocity of projection may be regarded as identical with the vertical velocity, giving

$$v^2 = 2gh = 32200$$

or $v = 180$ ft. per second very nearly.

Hence the angle of projection is so nearly vertical that the vertical part of the velocity exceeds the horizontal more than 1856 times. The inclination to the vertical would be almost exactly 1′ 50″, or $\varepsilon = 89°\ 58'\ 10''$.

The *St. Petersburg Herald* reports that Captain Kosztowitz is building at Okhta a large cigar-shaped balloon, 200 ft. in length and 80 ft. in height, including the car, which he has furnished with a screw and also with wings. He considers that he will be able to take a crew of sixteen men and 250 lb. of ballast, at the rate of forty German miles an hour, and the experimental trip is expected to take place early next month.

EMIGRANTS' PROSPECTS IN CANADA.

FROM AN ENGINEER'S POINT OF VIEW.

By W. R. Browne, M.A.

(*Continued from page* 237.)

IF Canada offers no field for English engineering, it does not follow that it offers no field for English engineers. The rapid development of the country, agricultural and otherwise, cannot but create a demand for manufacturing and repairing shops, and therefore produce favourable openings for capital in those directions. But capital is scarce in Canada, and what there is goes, most naturally, into the two great staples—land or timber. There are hundreds of young men now in England with a good engineering training, industrious habits, and a small capital to fall back upon, who yet find it almost impossible to get any suitable opening in Great Britain. Such a man might do worse than betake himself to Canada, and content himself for a year or two with earning journeyman's wages—say, 8s. a day—in some good country shop, keeping in view the hope of becoming a partner, in that or some similar concern, as opportunity offered. A sketch of one such country machine works, to which I paid a brief visit, will show the nature of the prospect thus offered. The works in question are situated at Sherbrooke, one of the most thriving and prosperous towns in what are called the "eastern townships" of the province of Quebec. In great measure it owes its prosperity to the fact that the River Magog, after passing through a succession of lakes, acting as natural reservoirs, here falls into the St. Francis in a succession of picturesque cataracts, having a total height of about 200 ft. It is only a small section of the fall with which we are concerned at the moment; yet this is sufficient to give, day and night, summer and winter, a continuous supply of not less than 700-horse power, which is utilised by an arrangement of high-speed turbines for the needs of a large three-storied building. One part of this building is occupied by the machine works now to be described; another by a mill for rasping up soft wood and converting it, by the addition of water, into a sort of fine gruel, which is afterwards pressed between rollers and turned into paper pulp. Yet a third part is occupied by a number of light tools for turning out bobbins of all shapes and sizes; and a fourth by the shops of a general joiner and undertaker. To return to the engineering works. They were founded about thirty years ago by an artisan from the United States, the present proprietor, whom I found working steadily at his vice among his hands, like an English millwright of the olden time. His son, who acts as outdoor manager and general foreman, took us round, and was ready to answer any questions. The fitting shop was occupied with a variety of machines, entirely of American or Canadian construction, but not wanting in solidity or excellence of finish. This was specially noticeable in a shaping-machine by Mackenzie and Bertram, of Dundee. Modern improvements were not wanting. For instance, a lathe, by the Putman Manufacturing Company, had an emery wheel mounted alongside the bed, which was traversing along it and rapidly polishing a roll for a paper-mill. A good deal of work is done in repairs for paper-mills, which form a considerable industry in this neighbourhood, and also in the repairs and erection of saw-mills and other wood-working plant. In addition, the firm contract—at day rates—to do all the repairs for two lines of railroad in the district. These are among the many new roads brought

into existence by the recent improvement in the fortunes of Canada, and are not yet sufficiently developed to have set up repairing-shops of their own. The work to be done for these includes the casting, boring, and pressing on of car wheels, the machining of locomotive castings, the boring out of cylinders, &c. If to this we add repairs to brewing plant, &c., and the erection of boilers and engines for various other tracks, it will be seen that there is enough to keep a shop of forty to fifty hands in full activity; and so, in fact, we found it. The castings turned out—from Scotch pig—were very good in quality, and the foundry was sufficient to run four or five tons per day. The boilers are, of course, chiefly adapted for burning wood, and are made with the large grates extending almost the whole way under the boiler; the gases return through tubes to the front, and thence pass by brick flues along the sides to the chimney. On the whole, the impression given by the general appearance of the works was that of a prosperous, increasing, and, above all, of a tolerably steady trade. The journeyman's wages, when in the shop, are 2 dols.—8s. 4d.—for a day of ten hours, and overtime is reckoned throughout at time and a half. Apprentices are taken, though without formal indentures, generally for a period of three years.

It must not be supposed that the building here mentioned contains all, or nearly all, the manufacturing enterprise of Sherbrooke. Lower down on the river is another and larger machine-shop—which, however, we had not time to visit—besides a file manufactory and other works. Higher up is the Paton Woollen Mill, on a scale which would not look small even in Bradford, running a large number both of looms and mules—the former mainly of American make, the latter bearing the familiar name-plate of Platt Brothers—and making excellent homespun cloth from Canadian wools, as well as finer qualities from South American, &c. With such mills, and with the aid of steam tailoring establishments, which are already in operation, there seems no reason why Canadian settlers should much longer have to pay more for their clothing than those they leave behind in the old country.

Hard by the woollen mills we inspected the fire-station of the town, whose complete appointments and spacious premises would have gladdened the heart of Captain Shaw himself. It was tenanted by some half-dozen magnificent Canadian horses, whose numbers are supplemented when required, in virtue of an arrangement made with the authorities having the care of the streets. It contained—besides hand machines—two steam fire-engines, one of the familiar Merryweather type, the other resplendent with nickel sheeting, &c., and bearing an American name-plate. We also inspected a "lumbering" establishment, placed at the very head of the fall, where there is a convenient site for a timber pond. The trees floating in this pond are brought up to the front of the works, where they are attached to an endless chain, and at once dragged up an inclined plane to the level of the sawmill. Here they are rolled on to a saw-bench, and presented to a large saw, which deals with them in a number of minutes which, if stated to an English audience, would hardly be credited. To reduce a good-sized log to rough 1½ in. planks seemed to require scarcely longer time than is needed to describe the operation. I was not able to learn the exact speed of travel, but am certain that it was at least 50 per cent. greater than that which is usual in English mills. Other saws were at hand—some large, some small, some hung on vertical, some on horizontal arms—for the purpose of reducing the rough planks to the various dimensions required. Planing machines, &c., were also forthcoming, together with special machinery for making "shingles" and "clap-boards"—the former going to cover the roofs, and the latter the sides, of the timber houses which form the general type of Canadian homesteads. As others' education, like my own, may be in default on the subject of clap-boards, I may explain that a clap-board is a light strip of wood, about 4 ft. long, 6 in. wide, and triangular in section, varying in thickness from ½ in. at the back to nothing at the front. When laid in strakes, even lapping each other by 3 in., with the thick edge downward, and well painted, they form an admirable and economical casing to a "frame house," as the luxurious dwelling of the modern Canadian farmer is termed, in opposition to the log hut of the early settler.

It will be seen even from this slight description that an English engineer coming to Canada will undoubtedly have something to learn—probably something also to unlearn; but it may be safely affirmed that, if only steady and energetic, he will never want employment, and that he will have opportunities of advancement open to him, such as it has long been hard to find in what, for good and for evil, is emphatically the "old country."

THE ENTOMOLOGY OF A POND.

By E. A. Butler.

THE BOTTOM (*continued*).

We have now to consider the life-history of caddis-worms. The parent insect, a moth-like creature living amongst the vegetation at the edge of the pond, deposits her eggs in the water, sometimes actually descending below the surface, and attaching them to the leaves of water-plants. But it is very seldom that they have been detected doing this. Mr. McLachlan speaks of having seen females of *Phryganea grandis*, one of our largest species, "on a calm summer evening *on* the surface of the water, with wings expanded and trembling, causing a commotion on the surface like that occasioned by a drowning insect; and as they took up the position voluntarily, and were evidently in no danger of drowning," he naturally came to the conclusion that they were depositing their eggs. But, again, on the other hand, females are sometimes found with their wings soiled, as though they had had a muddy bath, and had been contaminated thereby; so that in all probability there are different methods of conveying the eggs to suitable situations. The eggs, when first extruded, are enveloped in a gelatinous mass, and before being deposited in their final resting-place are often, for some time after actual extrusion, carried by the mother attached to the end of her abdomen. When in the water the gelatinous substance swells by absorption of the liquid, and attains twice its former diameter. The eggs soon hatch, but the young larvæ remain two or three days enveloped in the jelly; then leaving their cradle, which by this time is almost in ruins, they begin life on their own account, each constructing a tube for itself, proportionate to its infantile dimensions, and each species, even at this early age, manifesting the power of selecting appropriate materials for its domicile.

Fig. 1.

The larva (Fig. 1) has a pale, soft body, which is, no doubt, a tempting morsel to fish; and hence the necessity

for the protective case. The head and front segments, however, are hard and horny, as they are the only parts exposed when the creature is crawling. The head carries a pair of stout jaws, often notched at the tips. To the three segments immediately succeeding are articulated three stout pairs of legs, which have a wonderfully tenacious grip. To different parts of the body are attached in some species isolated threads, and in others bundles of the same, which are respiratory in function, *i.e.*, they contain branches of the tracheæ, and the interchange of gases is effected in the same way as previously described in the case of the dragon-fly larvæ. At the end of the abdomen of those that construct movable dwellings, there are two short, recurved hooks, by means of which the case is kept in position and dragged along. The larval stage is the great feeding-time; the insect takes no nourishment during pupahood, and probably very little in its adult stage, its only business then being the reproduction of its kind. But the larvæ seem to be able to endure prolonged fasting, and it would appear that they must pass the winter almost without food. After some months spent in the larval condition, the time for pupation arrives. The two ends of the case must now be closed sufficiently to guard the helpless being within from foes, but, at the same time, not so closely as to prevent the access of water for breathing purposes. Some species construct at each end a sort of grating of silken threads, others fix a quantity of vegetable *débris* in the same position. Some take a further precaution still. There is one called *Micropterna sequax*, which inhabits clear running water. This insect, before pupating, elongates its case by adding stones to one end, and then sinks it vertically in the mud, until it is almost entirely imbedded. To do this the larva turns round in its case, a gymnastic feat no doubt difficult of performance, but still rendered possible by the flexibility of its body and the dimensions of the case—and, thrusting its head and legs out at the wrong end, digs a hole and so lets itself down; this done, it resumes its ordinary position and patiently awaits its coming change. In three or four days the pupal stage is entered, and the creature is thereby much altered in appearance. It is no longer a caterpillar-like being; but all the organs of the adult insect appear—wings, legs, and antennæ being neatly folded down by the side of the body, each wrapped in a separate portion of the pellicle which enshrouds the whole creature. The peculiar arrangement of its limbs gives it a most amusingly sanctimonious expression. It is generally free in its case, though its only movements consist of oscillations of the body. When the time arrives, some two or three weeks after, for making its final transformation, it ruptures the grating at the larger end of its case, darts out of its prison cell with great speed, swims rapidly through the water by aid of its still encased legs, and on its back, like a water boatman, and thus makes its way to some dry place, where its thin pupal skin splits and allows the soft imago to creep out; some, however, do not take the trouble to leave the water, but, like gnats, merely float on the surface, and effect their transformation there, using the old pupa case as a raft on which to dry their wings.

Caddis worms are particularly careful not to expose more than the well-armed part of their body while walking, and even then, if an intruder appears, they will instantly and sharply retreat into their cases, when the only part exposed to attack is the hard head, and even this is not to be reached without entering the case. But, notwithstanding all their precautions, they do not succeed in escaping the attacks of those inveterate foes of insect life, ichneumon flies, and from one species also has been bred a two-winged fly belonging to a group well known for their habits of parasitism.

Though caddises are, as a group, aquatic in the larval state, there is one species the larva of which lives in moss at the roots of trees far removed from water. Nor are the insects absolutely confined to *fresh* water. One marine species has been reported from North America, and another from New Zealand, the latter of which formed a straight tubular case of fragments of coralline seaweed.

We may here notice some allied insects, the larvæ of the *Ephemeridæ* or Mayflies. These crawling things, which may easily be recognised by the three bristle-like appendages at the tail, and a number of leafy projections at the sides, do not make cases, but burrow in the muddy banks of ponds and streams, and constitute what is known to anglers as "bank-bait." The burrows are tubular, and, after running straight for a little distance, bend back upon themselves in the form of a U, and open into the water at both ends, so that the insect has no need to turn in its burrow, but can enter at one end and make its exit at the other. Small though they are, they are said to live two or three years in the larval condition, a remarkable contrast to the extreme brevity of their adult life, which is measured by hours, or at most by days. The pupa is similar to the larva, except that it exhibits traces of wings. When about to change into the winged form, it quits the water and "shuffles off its mortal coil," after the manner of several other insects already referred to; having so done, it looks like a perfect insect, and might fairly be expected to be such, but, marvellous to relate, it has yet another change to undergo—another skin to cast—before it reaches maturity. This is remarkable as being the only instance in the whole class of insects in which a change of skin is effected after the assumption of the winged form. So perfect is this last rejected vestment, when left sticking to the stalk or leaf which formed the disrobing place, that, like the cast armature of a crayfish or lobster, it might easily be mistaken for the complete animal itself.

(*To be continued.*)

THE INTERNATIONAL HEALTH EXHIBITION.

XIX.—THE SOFTENING OF WATER—(*concluded*).

IT now remains for us, in conclusion of our notes on the softening of water, to give an outline of the process devised by Mr. P. A. Maignen, which has been adopted by the Executive Council, and may be seen in operation at the aquarium tanks of the Exhibition.

The apparatus employed may be adapted to the wants of the household, or to the treatment of vast quantities. Fig. 33 is an explanatory drawing of the instrument now in use at the Exhibition. The upper left-hand corner of the engraving shows an automatic reagent precipitator. Fig. 34 is a diagrammatic drawing to represent the mode of action of this ingenious contrivance. It may there be seen that the water from the main works a paddle-wheel, which, in its turn, causes a revolution of the feed arrangement. Provision is thus secured for a supply of the reagent to the water to be treated, in proportions exactly suited to the requirements of each individual instance. The modified water is somewhat turbid through the precipitation of the lime salts which cause the hardness; it is, therefore, conveyed to an asbestos filter shown at the right-hand side of Fig. 33, and this filter is constructed upon the principle of the "Filtre Rapide." Thereafter the water, deprived of

its hardness, and cleansed of all its other impurities, passes on to the supply pipes.

The reagent used has been patented under the specific name of "Maignen's Anti-Calcaire." It consists of an admixture of lime, soda, and alum in proportions suitable to the requirements of each case. The inventor claims, with perfect justice, that when this powder is made to act upon hard water, it not only precipitates the carbonates, thereby correcting the temporary hardness, but also eliminates the sulphates, and thus gets rid of the permanent hardness. In passing through the indestructible asbestos filter, on to which the precipitated materials settle in such

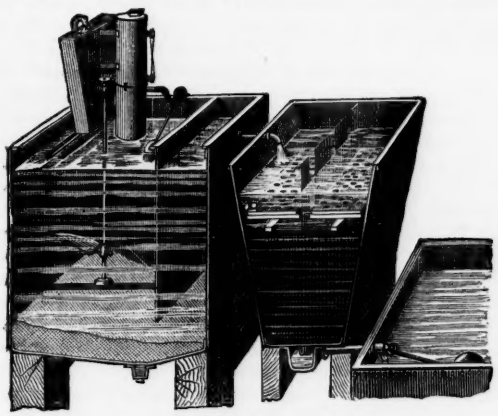


Fig. 33.

a way as to form a more perfect strainer, the water is admirably fitted for the use of manufacturers and engineers. A small portion of the *carbo calcis* added to the filter frame will deprive the filtrate of every other impurity, and render the supply a good potable water. We find that the "Anti-Calcaire," supplemented by the Filtre Rapide, is quite adequate to the production of a supply of the highest value to both the householder and manufacturer.

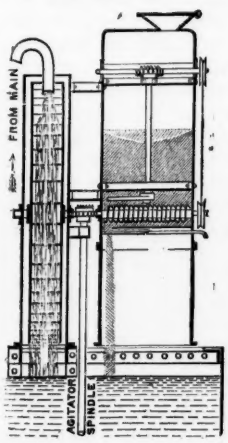


Fig. 34.

Fig. 35.

The next matter of importance is one of commercial significance—viz., its price. It is stated* that one pound of "Anti-Calcaire" powder suffices to soften from 300 to 500 gallons of water, that pound being retailed for the sum of 6d. It may also be interesting to know how it can be turned to account in the economy of an ordinary home; we therefore quote the following extracts for the benefit of our readers:—

"M. Alexis Soyer says that the quantity of tea which gives three cups with hard water will make five cups with soft water; so that a family which consumes 1 lb. of tea per week, say at 3s. per lb., would spend £7. 16s. per annum with hard water, whilst with soft water they would only require 32 lb., at 3s. per lb.—cost, £4. 16s. Thus the chalk present in the London water costs a family of five persons a loss of £3 a year in tea alone. To remove this chalk by our new system of softening water would only cost 3d."

"To soften 100 gallons London water with washing-powders and soap, the cost would be, say, washing-powders 5d., and soap (2½ lb. at 4d.) 10d.—total, 1s. 3d. To soften the same quantity by our precess would cost about 2d."

"The boilers, which would last ten years with soft water, are often worn out in two years with hard water; so that in the former case it is sufficient to deduct 10 per cent. for depreciation every year. In the latter, upwards of 50 per cent. must be deducted, to say nothing of the stopping of engines and loss of time. Hard water takes 8½ minutes to boil, whilst soft water boils in 6 minutes." *

Fig. 35 shows a convenient form of water-softening pan which is suited to the wants of a household. Into this small reservoir the "Anti-Calcaire" may be introduced, either automatically or by being merely thrown in. If the latter operation is resorted to, it will, during the course of a night, have acted sufficiently to convert the hardest into quite a soft water. Another household convenience which we would strongly recommend to the notice of our readers is the softening ewer, respecting which we are told to put "as much 'Anti-Calcaire' powder as will go on a shilling, fill with water, and allow it to rest all night." The water in the morning will come out of the tap soft and clear.

In our next communication we propose to treat of the purification of water in its relation to the pollution of rivers, and trust to be able to show how the great questions of sewage contamination and the utilisation of waste products from the habitations of man and his industries ought to be dealt with, by an examination and brief review of the so-called sanitary sections of the Exhibition.

* "Water, Preventable Disease and Filtration." By P. A. Maignen, 22 and 23, Great Tower-street, London, E.C., 1884. p. 30.

NOTES ON COAL.

By Richard A. Proctor.

(*Continued from p.* 255.)

IT is, in the first place, a remarkable circumstance that although vegetation was certainly not limited to the carboniferous period, yet it was in that period that all the chief coal-fields were formed. There are exceptions, no doubt, to this rule. In the times which preceded the carboniferous period, some coal-seams were formed, and some well-known coal-fields belong to later geological periods. There are beds of true coal belonging to the tertiary period (the latest of the main geological periods); and, passing from the oldest tertiary period to our own time, we find instances of the deposition of enormous quantities of *lignite* and *brown coal*, as well as of the formation of *peat*, which must be regarded as only needing submersion and consequent pressure to become, in the lapse of time, either true coal or very near akin to it.† Yet, it remains true that

* *Loc. cit.*, p. 30.

† "Near the surface," says Professor Ansted, "this substance (peat) is light-coloured and spongy, and the vegetable matter is little altered; deeper, it is brown, dense, and decomposed; at the bottom, it is black, and nearly as dense as coal." As a fuel, however, peat contains much ash. The same is true of lignite and brown coal. Moreover, brown coal is injured by exposure to the weather, which is not the case with true coal. Lignite splits in the air; brown coal falls to powder.

the carboniferous group is the coal-group *par excellence;* and when to this consideration is added the enormous thickness of the series of strata included in this group, we seem justified in concluding that this long period was characterised by some remarkable and distinctive peculiarity.

Now, whether we consider the lower portion of the carboniferous series remarkable for the masses of limestone derived chiefly from animal substances, or the upper, where the coal-seams or vegetable layers abound, we find evidences of the presence of enormous quantities of carbon. In the upper part, the mere existence of a most abundant vegetation implies the presence of vast quantities of carbonic acid gas in the air. It seems not unlikely that this gas escaped from subterranean regions through the outlets formed by volcanoes; and the idea is suggested that the carboniferous period was one of great volcanic energy. In the older periods, there was probably a greater degree of subterranean activity, and from the carboniferous period onwards, even until our own, movements of the earth's crust have been probably more irregular and violent. But it would seem likely that, in the carboniferous period, an intermediate state of things prevailed when, owing to the greater heat of the earth's crust, and consequently the greater relative thickness of the plastic subterranean portions of the crust, the movements were more steady, and affected wider regions than at present, while the relief given by volcanic craters, instead of being intermittent as at present, was afforded uniformly and on a grander scale.

If this were, indeed, the case, then, towards the close of the carboniferous period, great disturbances of the earth's crust might be expected to have taken place, since that would be the time when the chief volcanic vents ceased to relieve the pent up subterranean forces. This accords well with the condition of the geological record. "The termination of the carboniferous formation," says the author of the "Vestiges of Creation," "is marked by symptoms of volcanic violence" (by which he evidently means simply subterranean violence), "which some geologists have considered to denote the close of one system of things and the beginning of another. Coal-beds generally lie in basins, as if following the curve of the bottom of the seas; but there is no such basin which is not broken up into pieces, some of which have been tossed up on edge, others allowed to sink, causing the ends of strata to be, in some instances, many yards, and, in a few, several hundred feet, removed from the corresponding ends of neighbouring fragments. These are held to be results of volcanic movements below, the operation of which is further seen in numerous upbursts and intrusions of fire-born rock (trap). That these disturbances took place about the close of the formation, and not later, is shown by the fact of the next higher group of strata being comparatively undisturbed. Other symptoms of this time of violence are seen in the beds of conglomerate which occur among the first strata above the coal. These, as usual, consist of fragments of the elder rocks, more or less worn from being tumbled about in agitated water, and laid down in a mud paste, afterwards hardened.* It is to be admitted for strict truth" (rather a desirable object, by the way, in all such inquiries) "that, in some parts of Europe, the carboniferous formation is followed by superior deposits, without the appearance of such disturbances between their respective periods; but apparently this case is exceptional. That disturbance was general is supported by the further and important fact of the destruction of many forms of organic being previously flourishing, particularly of the vegetable kingdom."

It may be remarked in passing that the coal-seams are strikingly deficient in the fossil remains of animals. It is natural to ask, says Sir Charles Lyell, whether there were not air-breathing inhabitants of those forest regions where the accumulations of vegetable matter produced the coal-beds; but, if abundance of carbonic acid gas in the air were a main condition of the great vegetable wealth of the carboniferous period, the probability would seem to be that air-breathing creatures would be few, and those few of the lower orders of animal life. Certain it is that the poverty of the coal-seams in remains of animals has long been commented upon by geologists. We find footprints of a monstrous newt, or rather of an animal resembling the tadpole of the newt.* These creatures were truly amphibious, however, sharing the dominion of the water with the ganoid fishes—an association which "reminds us," says Lyell, "that the living" creatures of the same order "in America frequent the same rivers as the ganoids, the bony pikes." They were undoubtedly powerful swimmers, Professor Huxley considers; and, indeed, the main evidence we have of their having been air-breathers is the circumstance that they left footprints on the sand. If they had been walking under water, their weights would have been so much reduced that they would have left no impressions, or only faint ones, whereas these are deep and distinct. They are not unlike the impressions which would be left by a small and rather plump hand. It is by no means clear that this creature ever made its way into the ancient forests, or could be in any proper sense regarded as their inhabitant.†

I have mentioned impressions left in sand belonging to the carboniferous period, and the ingenious way in which geologists have explained the features of these impressions. There is, however, a record on the sandstone of this period, which is, perhaps, even more significant. Impressions of rain-drops have been detected in carboniferous sandstone by Dr. Dawson, Sir Charles Lyell, and, more recently, by Mr. Brown, in Australia; and these rain-marks are, on the average, about as large as those which are produced by the rain of our own period. As Lyell well remarks, "the great humidity of the climate of the coal period had been

* "Volcanic disturbances," adds our author in a note, "break up the rocks; the pieces are worn in seams, and a deposit of conglomerate is the consequence. Of porphyry there are some such pieces in the conglomerate of Devonshire, three or four tons in weight." It is evident from this note, following, as it does, on the above passage as to the older rocks, that the writer is speaking of subterranean disturbances, not volcanic action, properly so-called; for volcanic action does not break up the older rocks; that is the work of earthquakes.

* The reader will be reminded of the suggestive remarks, by the author of the "Vestiges of Creation," on similar tracks left by the *labyrinthodont* of Owen: "That massive batrachian which leaves its handlike footsteps in the new red sandstone, and then is seen no more. Not for nothing is it that we start at the picture of that strange impression—ghost of anticipated humanity—for apparently it really is so." It need hardly be said, however, that this is not the view at present entertained by naturalists.

† Owing to the circumstance that in our books on geology this creature is called a batrachian, many popular writers have been led to assert that a monstrous frog inhabited the ancient forests whence the vegetation of the coal-seams was derived. But the order of batrachians includes other animals than the frog and toad. According to the views at present adopted of the batrachian of the carboniferous period (as well as of a kindred but later species called by Professor Owen the *labyrinthodont*), this creature was further removed even than the newt from the common frog. It probably resembled in structure creatures still existing (but on a much smaller scale), which have four limbs like the newt, but have gills as well as lungs.

previously inferred from the number of its ferns, and the continuity of its forests for hundreds of miles; but it is satisfactory to have at length obtained such positive proofs of showers of rain, the drops of which resembled in their average size those which now fall from the clouds. From such data, we may presume that the atmosphere of the carboniferous period corresponded in density with that now investing the globe, and that different currents of air varied then, as now, in temperature, so as to give rise, by their mixture, to the condensation of aqueous vapour."

(To be continued.)

DICKENS'S STORY LEFT HALF TOLD.

A QUASI-SCIENTIFIC INQUIRY INTO

THE MYSTERY OF EDWIN DROOD.

By Thomas Foster.

(Continued from page 277.)

SIX months pass and we find Crisparkle waiting at the office of the Haven of Philanthropy for Mr. Honeythunder. We notice in this interview enough to show that Grewgious has not yet confided to Crisparkle his knowledge of Drood's safety. If we could feel any doubt on this point it would be removed by the interview between Crisparkle and young Landless. The interview between Crisparkle and Grewgious is much more significant however. We find that Grewgious is keeping a watch upon Neville Landless, obviously in the young man's interests. Can one doubt —seeing this—that Grewgious knows that about the disappearance of Drood which no one but Drood himself could have told him? In passing note that Mr. Grewgious could not possibly maintain this watch alone, and that undoubtedly Bazzard would be the man he would employ to share the work with him,—which would fully account for what he afterwards tells Rosa about Bazzard being "off duty in the office." Grewgious sits at the window watching, and even while Crisparkle is with him, detects the slinking figure of Jasper, who has followed Crisparkle to town. The two agree that Jasper's object is to keep a watch on Neville, haunting and torturing his life, and exposing him to perpetually reviving suspicion. Grewgious begs Crisparkle to leave him,—for "I entertain," he says, "a fancy for having our local friend under my eye to-night"—as well as Neville, and *not* in Jasper's interests. Mr. Grewgious's watch is maintained till late. Even when he retires to his bedroom, he looks out on Neville's chambers. Grewgious is thoughtful and anxious about Neville, and looks at the stars as if he would have read from them something that was hidden from him. He feels naturally anxious after what Crisparkle has told him about Neville's state, and after what they have both seen of Jasper's pursuit of him. Is it purely accidental that the next words—the opening words of a new chapter, bring Datchery—the most terrible of all Jasper's foes—upon the scene? I cannot think so.

"At about this time," we read, as if partly in pursuance of Mr. Grewgious's plans for relieving Neville, a "stranger appeared in Cloisterham; a white-haired personage with black eyebrows,"—who describes himself as "a single buffer living on his means," and to the jackass Sapsea as "a diplomatic bird." In passing, I remark that recognising Datchery as Drood, all that relates to him is full of fun (save for here and there a touch of pathos), but regarding him as any one else is stupid and unmeaning. If Bazzard were Datchery, the "Datchery assumption" is worse than unmeaning, it is bad literary workmanship. If Datchery is a mere professional detective (a view which Dickens himself enables us to reject), the Datchery matter is dull and heavy. Datchery can be no one else, unless he is Drood. But regarding him as Drood, every line about him is in Dickens's best manner,—and the character of Drood is very cleverly maintained, with just such modification as the terrible experience through which he has passed would render necessary. The "Mystery of Edwin Drood" would be worth reading if for nothing else but this clever bit of writing.

Datchery cleverly leads the waiter at the Crozier to suggest Mr. Tope as a likely party to tell him what he wants, or even to let the very lodgings he wishes to occupy for his watch on Jasper. On his way he becomes bewildered, boggling around the Tower, as if he felt "hot" in his search when he saw it, and "'cold' when he didn't see it." This, of course, is to prevent the ordinary reader from recognising Drood in Datchery; for Drood might be expected to know his way to Topes's. Yet any one who has wandered through the back streets of Cloisterham (Rochester) knows that even a resident might easily be bewildered there, and Drood was not a resident. The Crozier, we are expressly told, was a hotel of a most retiring disposition. But the description may easily be regarded as applying only to what Mr. Datchery seemed to do. It would have had a most suspicious appearance if, as a stranger in Cloisterham, Mr. Datchery had found his way too readily. Asking the way from the Deputy would serve a double purpose, nay a triple one;—1, testing his disguise; 2, starting an acquaintance with that useful little imp; and, 3, confirming the idea that he was a stranger in Cloisterham (for the Deputy was likely enough to talk at the Travellers' Rest).

The scene which follows is worth careful studying. Edwin Drood tries his Datchery assumption on four persons any one of whom might be expected to have recognised him unless his disguise were very perfect,—on Mrs. Tope, on Mr. Sapsea, on Durdles, and on Jasper (though Jasper assuredly had good reason for knowing, as he supposed, that, whoever Mr. Datchery might be, he could not possibly be Edwin Drood—Jasper in fact would be likely to be as blind to the truth, here, as the average reader whose ways Dickens so well understood). No wonder we find Datchery saying at the close of his afternoon's work, that "for a single buffer, living idly on his means, he has had a rather busy afternoon." Were he other than Drood the afternoon's work would have been easy enough.

Datchery's confused knowledge "of the Drood mystery, and the necessity under which he places Mrs. Tope to correct him in every detail," would be a little overdone were not Mrs. Tope so foolish a woman. His talk with "The worshipful the Mayor" is irresistibly funny when we think of him as Drood, but would be silly enough for any other detective. "Might I ask his Honor," he says, "whether that gentleman we have just left is the gentleman of whom I have heard in the neighbourhood as being much afflicted by the loss of a nephew, and concentrating his life on avenging the loss?" (Only a few minutes before Mr. Datchery had told Mrs. Tope he knew scarcely anything about the matter in which he now expresses so much interest). "That is the gentleman, John Jasper, sir." "Would his Honor allow me to inquire whether there are strong suspicions of anyone?" "More than suspicions, sir," returns the Jackass Mayor; "all but certainties." "*Only think now!*" cries Mr. Datchery. There is a world of meaning in this Droodlike and Dickenslike reply.

Later we have a touch of Dickens's observant manner, in the way in which Datchery puts his hand to his head,

XUM

"as if with some vague expectation of finding another hat upon it." Dickens himself, when taking part in private theatricals, must often have clapped his hand to his bewigged head that way.*

In the talk with Durdles, and again with Deputy, we catch a part of Edwin Drood's plan for punishing the man who has dealt so murderously with him. Truly he had had "a rather busy afternoon" of it.

(To be continued.)

ELECTRIC LIGHT DANGERS.

By W. Slingo.

THE very sad accident which occurred last Saturday week at the Health Exhibition, is one which will not be lost sight of for some time to come, and there is no doubt but that the champions of the gas interest will do their best to draw from it a moral which, it is to be feared, will be only too readily received by the great number of people ignorant of the circumstances. It will be remembered that the main features so far known to pertain to the accident were as follows:—Henry Pink, aged 21, an attendant employed in the dynamo shed, had one hand on one of the brushes of a 25-arc light Hockhausen machine (generating a current having an electro-motive force of several hundred volts). By some means he got his other hand either on the other brush or on another part of the machine, with the result that a part of the current passed through his body, and so caused his death; not instantaneously, however, but after a lapse of some minutes. It transpired at the inquest, which was held on the 1st inst., that strict instructions had been given to each employé not to allow both his hands on the dynamo at the same time. Such injunctions, however, are not always of very great utility, and we may easily suppose that in a moment of absent-mindedness, or when, perhaps, the existence of a small amount of vanity may infuse into the mind of a young man a desire to make an impression upon a wondering and wide-mouthed throng of sightseers, the injunction may be forgotten. It is to my mind a matter of wonder that accidents of this nature have not happened before. We know, too, the old saying that "familiarity breeds contempt," is as true in the treatment of dangerous commodities as between one person and another. One unused to the sight or to the work cannot but be impressed with the apparent recklessness with which many occupations are carried on—such, for example, as the manufacture and storage of explosives. In these occupations, however, the employers do their utmost to prevent accident, arising either from miscarriage in the process employed or negligence on the part of the workmen. But have we any evidence that such precautions have been systematically, or even occasionally, adopted for the protection of the men employed in electric light installations? I think we might search the whole country in vain; and yet what is easier, what more efficacious, than to provide an indiarubber glove for the one hand, leaving the other free to do that work which rarely, if ever, calls for both hands at the same time? Or, again, should there be any difficulty in placing a guard between the brushes of the machine which would permit the hand to be placed on or near one brush, but would not allow it to work round too close to the other? Guards might also be very easily devised which would, by imparting, say a slight prick, indicate that one is approaching dangerous ground.

It is most imperative that every possible precaution should be taken to guard against the recurrence of such an accident as this which has so rudely awakened us to the dangers to which many, perforce, young labourers are daily subjected.

But the question arises, What are these dangers? It is well known that the ordinary incandescent machines may be handled with impunity in their most powerful parts. To the untutored mind this is inexplicable. Nor is the reason so very clearly defined in the minds of more learned men. It is, nevertheless, a notorious fact that a current of as much as 200 volts can do little harm, while a current thrice as intense is more than dangerous. There are two, or even three, theories now current to explain the fact. One man supposes that only currents of very high electromotive force are capable of producing death, and in proof of this, deaths from lightning and from currents received from arc-lamp machines are quoted. Another man maintains that it is the strength or volume of the current which wreaks the damage; and, in proof of this, it may be pointed out that while the electricity produced by such a machine as the Holtz may have an electro-motive force of several thousand volts, the very high resistance in the circuit prevents it attaining the necessary strength, and so nothing more serious than a twitch or a jerk ensues. There is yet a third theory, which is well put by M. Gariel, in our Parisian contemporary, *L'Electricien*, in referring to the fatal accident which occurred two years since at the Tuileries. It appears that a well-insulated circuit was established, but that at a particular place one of the wires was enveloped in insulating material, while the other was bare, but supported on porcelain insulators. Two men, named Kenarec and Martin, respectively, came in contact with the bare wire, and they were both killed. According to M. Gariel—"The condition of double contact seems to have been produced in both cases. It appears from the autopsy that *both* the hands of Kenarec bore distinct traces of burning, and that in the case of Martin the cheek, the neck, and the ear, on the one hand, were distinctly burnt by contact with the wire, whilst on the other, the left hand presented a mark which may likewise be attributed to a burn.

"We are, therefore, led to the opinion that death resulted from a derivation of a part of the current through the body. The intensity of the derived current thus produced could be only a small fraction of the total current, for the resistance offered to the passage of the electricity by the organised parts traversed is enormous in comparison with the resistance of a copper wire six millimètres in diameter, and of a length of a few decimètres, which represents the distance between the points where the derivation was established. But it is far from being proved that, in the action of electricity upon organised beings, it is the intensity of the current—that is to say, the quantity of electricity—which determines the results produced. Perhaps even the fall of potential has to be taken into account. Perhaps, also (and we should be personally inclined to admit that it is so), it is the energy which determines the magnitude of the action, *i.e.*, the product of the quantity of electricity by the fall of the potential."

From the foregoing it is quite evident that we are still a long way from a knowledge of the quality of the electricity which kills a man. Nor are we much nearer a perception of what the effect is upon the system. There is little doubt but that death often results from such a shock to the nervous system as to bring about a stoppage of the heart, but where actual death results, when there is

* In Wilkie Collins's little story, "Love's Random Shot," a kindred use is made of theatrical knowledge.

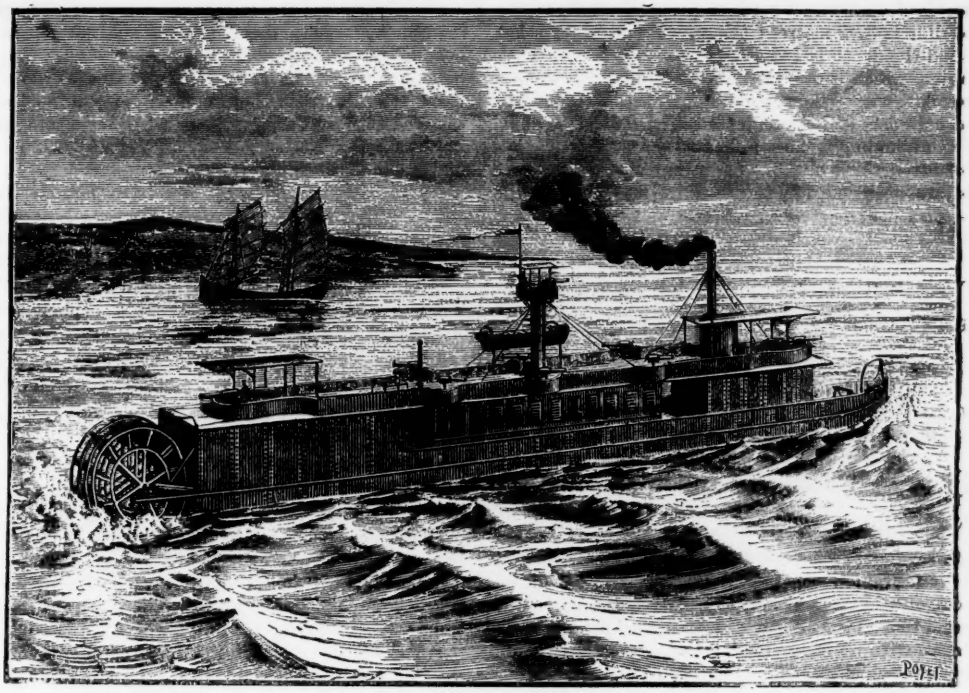


Fig. 1.—New French Stern-Wheel Gunboat.

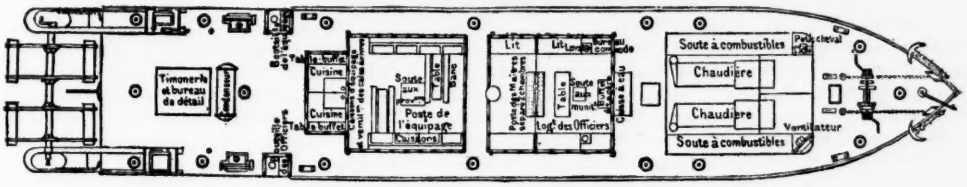


Fig. 2.—Plan of the Vessel.

not the slightest evidence of a shock having been imparted, we, or rather doctors, are still totally at sea in explaining the disaster.

There is, however, sufficient evidence to enable us to determine what does and what does not constitute a danger. Where there is a low electro-motive force, say, of 100 volts (as in machines for supplying incandescent lamps), however low the resistance of the dynamo, even if it be "decimal nought, nought, nothing," no harm can accrue because of the high resistance offered by the human body. Consequently it matters little, so far as personal safety is concerned, what the connections are or where they are made. With machines of high electro-motive force, however, the case is different. Bare wires should rarely if ever be permitted. The Paris accident above quoted clearly establishes this. Further, a complete metallic circuit should be insisted on, that is to say, the circuit should never be completed through the earth, otherwise danger attends every operation.

With proper care in planing and fitting, supplemented by average intelligence on the part of attendants or users, there is not more—nay, rather there is even less—danger to be apprehended from the adoption of the electric light than from gas. Nothing is here said about the many other advantages pertaining to illumination by electricity, my object being rather to point out what dangers really exist, and how easily they may be counteracted.

NEW STERN-WHEEL GUNBOATS.

OUR engraving gives a general view of one of the new stern-wheel gunboats that the Minister of the Navy and Colonies has lately built for service on the rivers Tonkin and Gaboon. These vessels, five in number, were constructed by the Société des Anciens Etablissements Claraped̀e. They bear the names of Henry Riviera, Carreau, Garnier, Berthe de Villers, and Pionnier. As they are designed to run upon Chinese and African rivers, whose waters are often very low, their maximum draught is 0·70 m., and their minimum speed is nine knots. They are provided with a 250 h.p. motor.

Each vessel consists of a flat-bottomed float of Bessemer or Siemens-Martin steel, of the first quality, thoroughly zinced. It is provided with three false keels, and the deck is surrounded with a rail. Upon the deck, and under a roofing are established cabins for the commander and crew. Above the roofing there is a platform arranged in such a way as to receive all the vessel's armament. The latter consists of two 90 mm. guns, one fore and one aft, and four Hotchkiss revolving guns. There are six places provided on the platform for three of these revolving guns, the fourth being stationed at the top of a hollow steel mast located amidship. The interior of the float is divided into twenty-eight compartments that contain the various store-rooms and magazines, as shown in the plan in Fig. 2.

The length of each vessel between perpendiculars at the load water-line is 37·2 mètres; the width amidships is 7·4 mètres; and the depth is 1·3 mètres.

The engine, which is of the compound type, is a surface condensing one, without expansion apparatus. It has two horizontal cylinders and direct connecting-rods, and develops, at a minimum, a 250 indicated horse-power, at a velocity of fifty-five revolutions per minute. Four of these gun-boats are designed for the Tonkin, and one for the Gaboon.—*La Nature.*

OTHER WORLDS THAN OURS.

A WEEK'S CONVERSATION ON THE PLURALITY OF WORLDS.

By Mons. de Fontenelle.

WITH NOTES BY RICHARD A. PROCTOR.

(*Continued from p. 257.*)

THE THIRD EVENING.—PARTICULARS OF THE WORLD IN THE MOON, AND PROOFS OF THE OTHER PLANETS BEING HABITABLE.

THE Marchioness was so intent upon her notions, that she would fain have engag'd me next day, to go on where I left off; but I told her, since the moon and stars were become the subject of our discourse, we should trust our chimæra's with no body else. At night we went again into the park, which was now wholly dedicated to our learned conversation.

"Well, Madam," said I, "I have great news for you; that which I told you last night of the moon's being inhabited, may be otherwise now. There is a new fancy got into my head, which puts those people in great danger."

"I cannot suffer this," said she; "yesterday you were preparing me to receive a visit from the Lunarians, and now you would insinuate there are no such people in nature. You must not trifle with me thus; once you would have me believe the moon was inhabited. I surmounted the difficulty I had, and did believe it."

"You are a little too nimble," I reply'd; "did I not advise you never to be entirely convinc'd in things of this nature, but to reserve half of your understanding free and disengag'd, that you might admit of the contrary opinion, if there be any occasion?"

"I care not for your suppositions," said she, "let us come to matter of fact. Are we not to consider the moon as St. Dennis?"

"No," said I, "the moon doth not so much resemble the earth as St. Dennis does Paris: the sun draws from the earth and water, exhalations and vapours, which mounting to a certain height in the air, do there assemble and form the clouds; these uncertain clouds are driven irregularly round the globe, sometimes shadowing one country, and sometimes another: he then who beholds the earth from afar off, will see frequent alterations upon its surface, because a great country, overcast with clouds, will appear dark or light, as the clouds stay, or pass over it; he will see the spots on the earth often change their place, and appear or disappear as the clouds remove: but we see none of these changes wrought upon the moon, which would certainly be the same, were there but clouds about her; but on the contrary, all her spots are fix'd and certain, and her light parts continue where they were at first, which truly is a great misfortune; for by this reason, the sun draws no exhalations or vapours above the moon; so that it appears she is a body infinitely more hard and solid than the earth, whose subtile parts are easily separated from the rest, and mount upwards as soon as heat puts them in motion; but it must be a heap of rock and marble, where there is no evaporation: besides, exhalations are so natural and necessary, where there is water, that there can be no water at all, where there is no exhalation; and what sort of inhabitants must those be, whose country affords no water, is all rock, and produces nothing?"

"Very fine," said she; "you have forgot how short a time since you assur'd me, we might from hence distinguish seas in the moon. Pray, what is become of your Caspian Sea, and your Black Lake?"

"All conjecture, madam," replied I; "tho' for your ladyship's sake, I am very sorry for it; for those dark places we took to be seas, may perhaps be nothing but large cavities; 'tis hard to guess right at so great a distance."

"But will this suffice, then," said she, "to extirpate the people in the moon?"

"Not altogether," I replied; "we will neither determine for, nor against them."

"I must own my weakness (if it be one)," said she; "I cannot be so perfectly undetermin'd as you would have me to be, but must believe one way, or the other; therefore pray fix me quickly in my opinion, as to the inhabitants of the moon: preserve or annihilate them, as you shall think fit; and yet methinks I have a strange inclination for 'em, and would not have 'em destroy'd, if it were possible to save 'em."

"You know, madam," said I, "I can deny you nothing; the moon shall be no longer a desert, but to do you service, we will repeople her. Since to all appearance the spots in the moon do not change, I cannot conceive there are any clouds about her, that sometimes obscure one part, and sometimes another; yet this does not hinder, but that the moon sends forth exhalations, and vapours. The clouds which we see in the air are nothing but exhalations and vapours, which at their coming out of the earth, were separated into such minute particles, that they could not be discern'd; but as they ascend higher, they are condens'd by the cold, and by the re-union of their parts, are render'd visible; after which they become great clouds, which fluctuate in the air, their improper region, 'till they return back again in rain to us: however, these exhalations and vapours do sometimes keep themselves so dispers'd, that they are imperceptible; or if they do assemble, it is in forming such subtile dews that they cannot be discerned to fall from any cloud. For as it seems incredible that the moon should be such a mass, that all its parts are of an equal solidity, all at rest with one another, and all incapable of any alteration from the efficacy of the sun; I am sure we are yet unacquainted with such a body. Marble itself is of another nature; and even that which is most solid is subject to change and alteration; either from the secret and invisible motion it has within itself, or from that which it receives from without. It may so happen, then, that the vapours which issue from the moon may not assemble round her in clouds, and may not fall back again in rain, but only in dews. It is sufficient for this that the air with which the moon is environed (for it is certain she is so,* as well as the earth) should be a little different from our air, and the vapours of the moon be a little different from those of the earth, which is very probable. Hereupon the matter being otherwise disposed in the moon than on the earth, the effects must be different; though it is of no great consequence whether they are or no; for, from the

* Some of the confidence of half-knowledge is here shown by our worthy author.—R. P.

moment we have found an inward motion in the parts of the moon, or one produced by foreign causes, here is enough for the new birth of its inhabitants, and a sufficient and necessary fund for their subsistence. This will furnish us with corn, fruit, water, and what else we please, I mean according to the custom or manner of the moon, which I do not pretend to know, and all proportioned to the wants and uses of the inhabitants, with whom I pretend to be as little acquainted."

"That is to say," replied the Marchioness, "you know all is very well, without knowing how it is so, which is a great deal of ignorance founded upon a very little knowledge. However, I comfort myself that you have given the moon her inhabitants again, and have wrapped her in an air of her own, without which a planet would seem but very naked."

"'Tis these two different airs, madam, that hinder the communication of the two planets: if it was only flying, as I told you yesterday, who knows but we might improve it to perfection, though I confess there is but little hopes of it? The great distance between the moon and the earth is a difficulty not easy to be surmounted; yet were the distance but inconsiderable, and the two planets almost contiguous, it would be still impossible to pass from the air of the one into the air of the other. The water is the air of fishes; they never pass into the air of the birds, nor the birds into the air of the fish; and yet 'tis not the distance that hinders them, but both are imprisoned by the air they breathe in. We find our air consists of thicker and grosser vapours than the air of the moon; so that one of her inhabitants arriving at the confines of our world, as soon as he enters our air will inevitably drown himself, and we shall see him fall dead on the earth.

(*To be continued.*)

TRICYCLES IN 1884.

By John Browning,

Chairman of the London Tricycle Club.

A NEW TWO-SPEED GEARING.

HIRST, of West Croydon, the well-known maker of specially-light tricycles, has just perfected yet another Two-speed Gearing. This arrangement, proposed in the first place, I believe, by Mr. Rich, seems to be as simple in plan and efficient in action as such a contrivance can well be made. It is like several other arrangements intended for a similar purpose,—to a certain extent, a modification of the well-known sun-and-planet action.

When the machine is geared to travel at speed, a small-toothed wheel is *locked* in the centre of the lower chain-wheel, and the whole of the parts work together without extra friction. When it is desired to drive with more power, but, of course, at a lower speed, a slight turn of a spade-handle unlocks the toothed wheel, and a movement forward shifts the chain-wheel, so that a hollow toothed ring inside the chain-wheel engages into the teeth of the small central cog-wheel previously referred to. In this condition the chain-wheel is driven through the intermediation of the cogs, and I may say at once that it performs well.

Before saying this I have had opportunities of testing the contrivance severely, as I have had it applied to my small Sociable made by Hirst, which is one of the most perfect machines I would ever wish to ride. I have tried a machine belonging to the maker, and Mr. Grace has kindly placed the first machine of the kind, which was made specially for him, at my disposal. My own machine was geared exceptionally low, and the maker's rather unusually high. Mr. Grace's machine was geared to 39 in. for power and 52 in. for speed, a combination exactly suited to my requirements. This machine is a front-steerer with 40-in. driving wheels, having $\frac{7}{8}$-in. rubber tires, and a 20-in. steering-wheel with 1-in. rubber tires. The machine weighs 82 lb., but it was weighted with touring requisites so as to weigh about 90 lb.

I started with this machine, and rode thirteen miles, of which about ten or eleven miles were up-hill; then I rode it with the high-speed gearing up a long and tolerably steep hill, and immediately, without resting, changed to the power gear, and rode it up another hill still longer and steeper.

Under all circumstances, both the machine and the gearing arrangement acted admirably. I could not suggest any alteration in them which would be likely to improve them.

My own small Sociable, the first Cobweb made, I have ridden 150 miles, accompanied by my wife, with the new gearing on it, and this has behaved just as well.

One ride we took from Reigate to Worthing, and on to Littlehampton, in one day, and the next went on to Arundel and Chichester. The last stage of this ride, about eleven miles, includes, I should think, eight miles of short, rather steep hills. Just before we reached Arundel it had been raining hard for several hours, so that the roads were very heavy, and we had a strong wind against us; yet we rode the eleven miles in one hour and three quarters with only one dismount, and walked less than a quarter of a mile. Had the machine not been provided with this excellent hill-gearing, we must have dismounted nearer a dozen times and walked through the mud for several miles.

There is, I regret to see, a strong disposition on the part of many writers to undervalue the usefulness of two-speed gearings. It is, I think, unfortunate, as it acts against the spread of tricycling that nearly all the articles written on the subject are written by athletes who have for years ridden bicycles and tricycles, and who can, by the aid of strong muscles and incessant practice, drive nearly any machine along at the rate of from ten to twelve miles an hour. From such a rider I received a letter a few days since, in which he says:—"How differently we are constituted; most of us, when we have a two-speed gearing, never think of using it; we prefer using a little more muscle, and making progress to show with it."

Of course, this is a hint that all other riders should do the same. The advice is very like the Dutchman's direction, "You must go along the road as far as you can, and then you must go a little further."

For the pace to be satisfactory, a high-gearing must be used, say from 54 to 57. Let the rider of a machine so geared come on to very rough or muddy roads, or against a high wind, and he must either walk or submit to slavery. But if the machine has two-speeds, with a lower-gearing to fall back upon, then the high gearing has not this drawback to contend against.

About a fortnight ago I rode 63½ miles on my two-speed Rucker in 6 h. 57 m., over a right-away road, and left off fresher than I began. I did not dismount for any hill in the whole distance. I was accompanied by my friend Mr. Arthur Salmon, who took the time and checked the distance with maps, road-books, and a cyclometer. I feel certain this ride would have been impossible for me without a two-speed gearing. Seven miles an hour is as much as I care to ride for a distance of fifty or sixty miles on an ordinary machine; the pace of over nine miles an hour was only achieved entirely by the use of the double gearing.

When racing on a prepared path, two-speed gearings are,

of course, unnecessary, but I think it cannot be too clearly understood that road-riding and path-racing have nothing in common with each other; one is a sport, the other is a healthful recreation. They are as little connected with each other as horse-riding and horse-racing.

In describing the Emperor tricycle in my last paper, I unwittingly did the machine some injustice by stating that it required an arrangement for tightening the chain, in the event of its becoming slack, owing to strain or wear and tear. I find that it is provided with a very simple and efficient contrivance for tightening the chain, so ingeniously contrived and well made, that it easily escapes notice; the upper part of the lower chain-wheel bracket turns on a hinge, and counter-nuts, on a cantilever rod, secure it in any position.

Since the above was written, 100 miles have been ridden by Mr. George Smith over right-away roads on a Kangaroo safety bicycle in 7 h. 10 m.—that is at the rate of fourteen miles an hour. The bicycle driving-wheel was only 36 in. in diameter, and it weighed 40 lb., yet it was driven faster than any machine with a 60-in. wheel has ever been ridden 100 miles before. Can anything more be wanted to show the absurdity of fitting up tricycles with 48-in. driving-wheels?

Mr. Webb, of the London Tricycle Club, has ridden the same 100 miles in 7 h. 35 m., and he would have ridden in less time but for an accident.

Mr. Webb rode a Humber tricycle with 42-in. driving-wheels, which weighed about 48 lb.; if Mr. Webb's Humber had had 36-in. wheels, the weight of his machine might have been reduced several pounds, and it is quite possible that he might have beaten the bicycle, instead of being beaten, as a very few pounds difference in weight would have made from 20 m. to 25 m. difference in a 100 miles' ride.

Editorial Gossip.

I have discovered (experimentally) a very real source of danger in mountain climbing—I mean that arising from a sudden gust of wind striking you when you are on a narrow and precipitous ridge. You may possess the best imaginable "head"—be able to look down a sheer precipice without feeling giddy, and be, normally, as firm on your feet as need be; but to be twisted laterally by a sudden squall may not impossibly result in your losing your balance, and making a *facilis decensus* which you will never repeat on this earth.

The opinion which I pronounced here, colloquially, on "the Healtheries," some time ago, has since been uttered more authoritatively by Herr Hartmann, of Berlin, in his report of that show to the meeting of the Society for Health Technics at Frankfort. In it, speaking of the Health Exhibition, he says: "Indeed, from a scientific point of view, it was simply pitiable." If the Commissioners of the Exhibition of 1851, and the other Highnesses and Mightinesses at South Kensington ever read such an essentially common poet as Burns, they will recollect his prayer for the gift "to see oorsel's as ithers see us."

I see by the English papers that the curate of a parish in one of the home counties, a week or two ago, attributed (from the pulpit) the shortness of the hop-crop to the fact that the farmers in the locality, which he must at once adorn and illuminate, did 'not come to church! A fact which he emphasised by pointing out that only three of them were present to listen to the very edifying address in which this astonishing dogma was propounded. It is stated that the church-going farmers felt this to be "the unkindest cut of all," inasmuch as their crops of hops were no whit better than those of their Nonconformist neighbours.

As every one knows, at present, the initial meridian from which longitudes are reckoned varies with the nationality of the ephemeris-computer or map-maker, although, from the wide diffusion of the "Nautical Almanac," Greenwich is a very generally accepted one. The Geodetical Congress last year was practically unanimous in the recommendation that it should be universally adopted; and I had hoped that the existing confusion might have been abolished by the universal acceptance of that recommendation. The only dissidence at all to be expected was from that neighbouring nation whose entire metrical system is founded on an erroneous measurement of a local arc of the meridian, and whose action towards other countries generally in matters scientific, literary, social, and political, is modelled on that of the militiaman, who, on being reminded by his left-hand man that he was out of step with the whole battalion, replied, "Change your'n, then!" France now declines to support the proposition, but favours a so-called neutral meridian throughout the Azores or Behring's Strait, as a means of defeating the choice of Greenwich.

I do not fancy that astronomy can be much cultivated in the Isle of Man, as I learn from a correspondent of unquestionable veracity that recently it was determined to hold a bazaar for Church purposes, at a village on the western side of the island; and that an old inhabitant reputed to be learned in the stars was consulted as to the probability of fine weather. After pondering the matter for a night and a day, he returned this oracular response: "Oh! yes, have the bazaar, the day will be fine; the planets are favourable. *Juniper* and *Vesuvius* are in conjunction." What an acquisition this prophet of Mona's Isle would be to the Solar Physics Committee, to be sure!

I shall look out curiously for accounts of Observations of the Lunar Eclipse of last Saturday night. At the place whence I write the effect at the time of totality differed from any which I have ever previously witnessed. Ordinarily, at the time of greatest obscuration, the moon has assumed the appearance of a huge glowing coppery-red ball hung up in the sky. On Saturday she was barely visible as an ill-defined ring of a sickly green hue. If, as is practically certain, the usual ruddy tinge of the moon when totally eclipsed has its origin in the refraction of the sun's rays through our own atmosphere into the shadow-cone, that atmosphere must have been laden with *something* which acted as a dense screen to them on the night of the 4th. Are we here once more brought face to face with the cause of the persistent haze in the sun's neighbourhood, and of the wonderful fore and afterglow?

M. C. Flammarion has received anonymously a sum of 5,000 f. to be awarded as a prize to the author of the best project for the reform of the Calendar. Doubtless, a competition is the best method of finding out the difficulties of such a reform; as also the direction it should take without upsetting established customs. The editor of *L'Astronomie* has therefore opened a competition, in the hope that those *savants* who will undertake the task will be able to produce some simple, definite method appreciable to all nations. Papers must be sent in by Oct. 1, 1885, to M. Flammarion, 36, Avenue de l'Observatoire. A committee will read the papers, award the prize, and propose the reform to an international congress.

Reviews.

SOME BOOKS ON OUR TABLE.

International Health Exhibition Handbooks:—"Athletics," "Infectious Disease and its Prevention," "Diet in Relation to Health and Work," "Healthy Nurseries and Bedrooms," "Health in the Workshop," "Alcoholic Drinks," "Healthy Furniture and Decoration," "Ventilation, Warming, and Lighting for Domestic Use," "Accidental Injuries," "Dress, and its Relation to Health and Climate," "Healthy and Unhealthy Houses in Town and Country." (London: Wm. Clowes & Sons. 1884.)—These handbooks form a continuation of that series of remarkable shilling's-worths which we noticed on p. 13. One and all excellently done, we may perhaps single out such of them as Messrs. Eassie & Field's "Healthy and Unhealthy Houses," Mr. Cantlie's "Accidental Injuries," and Mr. E. W. Godwin's "Dress," as possessing an interest which will survive when the Health Exhibition itself has sunk into oblivion. We do not, however, desire to make invidious distinctions where all have performed their work so well; and the reader who takes an interest in any of the subjects indicated in the list of titles above may invest his shilling with the certainty that he will get his money's worth for his money.

Technological Examinations of the City and Guilds of London Institute. (London: Gresham College. 1884.)—From the report whose title heads this notice we observe that out of 3,635 candidates who presented themselves in May last for examination in various branches of technology, only 1,829—or, as nearly as may be, one-half—succeeded in passing. Moreover, we note that the percentage of failures has risen from 37·5 in 1883 to 49·7 in 1884. The reasons for this are set down fairly and candidly in the reports by the various examiners. Want of skill in drawing seems to be a very fruitful source of "plucking" among the competitors. *Malgré* this, the institute seems to have done good useful work, and had it only stuck to the *locale* in which so much of that work has been accomplished and devoted, the money so shamefully wasted (in the interests of a jobbing clique) on the costly and inconvenient building at Brompton, and to the endowment of technical education at King's and University Colleges, its sphere of usefulness might have been indefinitely extended.

W. & A. K. Johnston's Natural History Plates. (W. & A. K. Johnston: Edinburgh and London.)—We have seen nothing so far to excel, if, indeed, we have seen anything to equal, these beautiful engravings, which are produced of a large size for wall prints. The three before us, of the elephant, camel, and domestic cat, respectively, are excellent reproductions of the animals they pourtray; the print of the elephant, in particular, being really admirable. No better way could be devised of teaching the rudiments of zoology to children remote from menageries than that afforded by such plates as these.

W. & A. K. Johnston's History Chart. (W. & A. K. Johnston: Edinburgh and London.) — Here is another remarkable essay in the way of boiling down history! In a table, or set of tables, extending over four sheets, the student may see, almost at a glance, the leading facts in the histories both of England and Scotland. Nay, he may even familiarise himself with the personal aspects and manners of the various sovereigns who reigned over these countries from the time of the Norman Conquest; both as separate Kingdoms, and, subsequently, as an united one!

THE FACE OF THE SKY.

From October 10th to October 24th.

By F.R.A.S.

SIGNS of activity in the shape of spots and faculæ continue to appear on the Sun, which should hence be examined by the student daily. The night sky is portrayed on Map X. of "The Stars in their Seasons." There will be minima of Algol ("The Stars in their Seasons," Map I.) at 1h. 12m. in the early morning of the 18th, at 10 p.m. on the 20th, and at 6h. 49m. p.m. on October 23. A minimum of Mira Ceti, too (Map XII. of same work), may be looked for on the 24th. Mercury is a morning star during the succeeding fortnight, and but indifferently placed for the observer. Venus is a morning star, too, shining brilliantly over the eastern horizon before 2 a.m., and being still a very conspicuous object. Mars is invisible, and Jupiter, as a morning star, does not rise until an hour at which the ordinary amateur would scarcely care to look for him. Saturn, though, rises between four and five minutes past 10 o'clock to-night, and about 9h. 12m. p.m. at the end of the fourteen days. Hence he may be fairly seen by midnight, and a beautiful spectacle he presents. He is a little above ζ Tauri ("The Stars in their Seasons," Map I.). In the eastern confines of Taurus, too, Neptune may be picked up now, but needs an equatoreal for that purpose. Uranus is invisible. The Moon enters her last quarter at 2h. 29·2m. p.m. on the 11th, and is new at 31·4 minutes after midnight on the 18th; so that very little will be seen of her practically until the end of the fortnight we are considering. Only one occultation, at anything like a convenient hour, will happen during that period: it is that of the 6th mag. star, A^2 Cancri, which will disappear at the moon's bright limb at half-past twelve o'clock on the night of the 12th, at an angle from her vertex of 345°, and reappear at her dark limb 28 min. afterwards, at an angle of 281° from her vertex. The moon, situated at noon to-day in the confines of Orion and Gemini, passes into the latter constellation very shortly afterwards. She quits Gemini for Cancer at 3 a.m. on the 12th, continuing in the last constellation until 5 p.m. on the 13th. Then she travels into Leo, descending at 6 p.m., on the 14th, into Sextans, but re-emerging in Leo at 10 o'clock the next morning. She finally quits Leo for Virgo at 11 a.m. on the 16th; and it is not until 7 p.m., on the 19th, that she has completed her journey across this great constellation and entered Libra. At 8 p.m., on the 21st, she leaves Libra for the narrow northern strip of Scorpio, passing out of this into Ophiuchus at 7 o'clock the next morning. At 5 a.m., on the 24th, she crosses into Sagittarius, and there we leave her.

WOLF'S COMET.

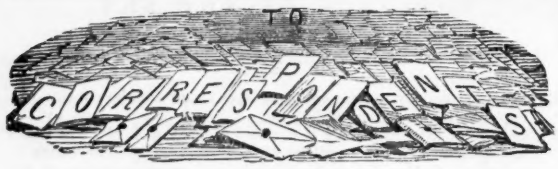
THE following Ephemeris (if employed in conjunction with either the "New Star Atlas" or the "Larger Star Atlas" of the conductor of this journal) will enable the observer to follow the Comet in its passage through the sky during the next twelve days. It is slowly increasing in brightness:—

At Berlin midnight: *i.e.*, 11h. 6m. 25·1s. p.m. Greenwich Mean Time.

October	Right Ascension. H.	M.	S.	Declination North. °	′
10	21	32	15	12	36·8
11	21	33	33	12	5·4
12	21	34	53	11	34·0
13	21	36	16	11	2·6
14	21	37	41	10	31·3
15	21	39	8	10	0·0
16	21	40	38	9	28·8
17	21	42	10	8	57·7
18	21	43	45	8	26·7
19	21	45	22	7	55·8
20	21	47	2	7	25·1
21	21	48	45	6	54·6
22	21	50	31	6	24·2

We are indebted to Dunecht Circular No. 91 for the above.

A remarkable discovery of topazes has been made in New South Wales. A portion of a large bluish-green crystal, weighing several pounds, found at Mudgee, is now in the colonial museum. Some crystals, from two to three inches in length, have been found in Uralia. One found at Gundagai weighs 11 oz. 5 dwts., and one from Gulgong weighs 18 oz. avoirdupois.



"Let Knowledge grow from more to more."—Alfred Tennyson.

Only a small proportion of Letters received can possibly be inserted. Correspondents must not be offended, therefore, should their letters not appear.

All Editorial communications should be addressed to the Editor of Knowledge; *all Business communications to the* Publishers, *at the Office, 74, Great Queen-street, W.C.* If this is not attended to delays arise for which the Editor is not responsible.

All Remittances, Cheques, and Post Office Orders should be made payable to Messrs. Wyman & Sons.

The Editor is not responsible for the opinions of correspondents.

No communications are answered by post, even though stamped and directed envelope be enclosed.

SHOOTING STARS AND METEORS.

[1437]—Permit me to remark, in reply to "Eye Witness," that in the first place, it is certain that all shooting stars, and probably a good many meteors, which are not heated to luminosity approach so near the earth that its attraction must, for the time at least, be much more powerful than that of the sun. This attraction must materially alter their orbits, and, with regard to those which enter our atmosphere, a further alteration is caused by its resistance. In the next place, considering the great velocity of the earth in its orbit and the very considerable depth of its atmosphere (the resistance of which increases the further the shooting star advances in it), the motion of the meteor in rushing through the atmosphere may be so retarded that the solid body of the earth has cleared its track before it reaches the point where a collision would have occurred if the original velocities were unaltered. This, I think, would probably occur if the meteor was vaporised. Vaporisation by itself would have no tendency to arrest the motion of the meteor, but the moving vapour would be much more retarded by the resistance of the atmosphere than the moving solid. Thirdly, it is no explanation of what becomes of the vaporised meteors to describe them as disintegrated. The question is, what happens afterwards? We can hardly suppose them to remain in their gaseous condition in the atmosphere, after the great heat which converted them into vapour has passed away. If not, they must again solidify, and either fall to the earth (probably in fine dust) or else get clear of the atmosphere and pursue a course in space, which can hardly coincide with their former orbits. But where did the meteors which formed the great star-showers of 1866 and 1872 fall? And if they did not fall, where are they now?

The ring-system of Saturn may have originated in the manner which "Eye-witness" suggests, but whether other planets would be similarly affected is by no means clear. The formation of such a ring would probably depend on several causes—the mass and volume of the planet, the extent and resisting power of its atmosphere, its distance from the sun (which by lessening the sun's attraction would render it more easy for the planet to attach the meteor system to itself), the relative velocity of the planet, and the meteors, and the angle at which their orbits intersected; but, above all, on the number and mass of the meteors, whose orbits intersected that of the planet. Our greatest star-showers arise from the meteors attached to comparatively insignificant comets. If the orbit of a great comet intersected that of Saturn, under favourable circumstances, a ring might naturally result. Such a ring, however, could hardly be formed within the limits of the atmosphere of any planet, owing to the resistance of the latter to its motions.

W. H. S. Monck.

THE AFTERGLOW AND ITS CAUSE.

[1438]—I differ entirely from "F. G.S." as to the cause of the afterglow. I beg to state that, according to the incontestible assertion of an influential member of the Krakatoa Defence Committee, I kicked up my dust into space far above the limits of the earth's atmosphere; it consequently remains suspended in space. The earth has again reached that portion of space: hence I, and no one else, am clearly the sole cause of the beautiful phenomenon which delights the eyes of thousands all over the world.

Krakatoa.

[What *can* be more convincing?—Ed.]

[1439]—The sunsets and afterglow are now being repeated with an intensity equal to those of last year. The first, more remarkable than usual, was on the 18th of this month succeeded by others on the three following days, that on Saturday, the 20th, being equal to anything seen here last year. Till last evening, the sky has been overcast at sunset. The afterglow then and this evening lasted till 6.40 and 7 respectively, the colour being red and orange, shading off to pinky purple at the outer edge of the glow. Last evening, the whole eastern horizon was, during the afterglow, spanned by a pink arch, shading off to pinky purple, the glow on the higher mountains being at the same time very remarkable.

The halo or haze round the sun has been more conspicuous this month, and of a deeper copper hue. On the evenings of the 1st, 2nd, and 3rd, the moon had a similar halo. I may add that I have never once this year seen the sky of the intense blue usual here, and that I have been unable—on some days apparently clear—to detect Sirius and other stars at transit, usually distinctly visible by day in my instrument. On these days the solar haze seemed to be of a deeper copper.

Notes of last year's sunsets and afterglows observed by myself and others were sent by me privately to another scientific journal, but having been made the subject of insulting editorial comment—the editor's apparent wish being to prove Krakatoa responsible for the afterglow—I prefer on this occasion to send them to Knowledge, in the hope that they may be acceptable as helps towards a solution of the afterglow difficulty.

M. F. Ward.

P.S.—I omitted in my letter yesterday to state that whether seen from the plain or from a height of 2,000 ft. or 3,000 ft. above it, the colouring of the afterglow is the same, the evening haze or mist which exists in the plane not affecting it in the least.

Partenkirchen, Bavaria, Sept. 27, 1884.

[I have received another letter from Captain Noble on the same subject, which is too long for insertion here. In it he quotes from a second communication recently received by him from Mr. Neison, the Government Astronomer at Natal, in which that eminent man of science reiterates the expression of his great surprise that any of his confrères in Europe should attribute to the Krakatoa dust a phenomenon occurring repeatedly under circumstances which rendered it impossible that the Javan Volcano could have had anything to do with it; in point of fact, long before the eruption ever took place at all.—Ed.]

VISUAL PHENOMENA.

[1440]—Referring to letter 1,296, by Mr. P. J. Beveridge, on "Squinting," I should like to make a few remarks which may not be altogether irrelevant.

As regards the eye becoming tinted with the complementary of the colour at which it looks fixedly, I have observed that this effect becomes so marked if the stare be continued, that if a person gaze steadily at anything, keeping his eyes fixed *on one point* all the while, he will soon see nothing. This remark would seem to answer the question put in the second paragraph of above-mentioned article, and I think that the fact of our becoming deaf to a continued sound, and blind to a continued scene, may be all referred to the principle, that we can only be cognisant of any fact, idea, or impression by its difference from that which preceded it (we only judge by comparison). Thus, we see that monotony causes oblivion of ideas, as seen in the case of persons who have been lost in some mammoth cave, being found in a temporary state of insanity, attributable to the oppressive silence reigning in these places.

Respecting the question asked by Mr. Beveridge, whether any one had effected a super-imposition by divergence of the eyes to a more distant point, I may mention that this is my regular practice with stereoscopic views, and could, therefore, not understand the object of the wicked destruction recommended, until reading the last paragraph. I think any one could succeed in doing this with a little practice.

Ali.

LIFE AFTER DEATH.

[1441]—"Eye-Witness" represents soul as an entity, distinct and independent of the body. Now, may I ask where is or was this immortal entity before the body came into existence? what did it do? where are all the souls "yet to come into bodies" not yet born? Or can "an immortal" thing be born? The idea of immortality appears to me to be born of the wish for it.

Again, I see with my eyes, smell with my nose, hear with my ears, feel with my nerves, think with my brain. What can the soul do without the body and the senses? All these organs are, as science teaches us, entirely destroyed in death, and used up—every atom of them—to build up other and similar lives and living bodies. The soul, therefore, having no senses, again I ask what can it do? It can't see, hear, smell, feel, or think. What does it do? How does it occupy its existence?

Mr. S. Thorne's letter completely expresses my thoughts and experience on this important matter. When we are asleep, in sound, dreamless sleep, consciousness of soul is gone. Where? As it often happens when men are severely injured, they are unconscious, soulless for periods of weeks and months; that whole time is a perfect, entire blank to them when consciousness returns, although all other life functions went on as usual. All this appears to point to the same conclusion, that mind and soul are functions of the brain and nerves, which cease with death.

F. W. H.

[1442]—Will you allow me to put to Mr. Thorne the common-sense question which must have risen to the lips of hundreds as they read his extraordinary letter in your last issue? Was the man *dead*, or was he not? Mr. Thorne hardly ventures to say he was, but talks about his being "practically" so. The idea that a man really dead could by ordinary methods be brought to life again is so utterly unscientific that I am driven to suppose that Mr. Thorne would, if pressed, admit the second alternative. Life was, therefore, merely suspended. If this be so, the case was exactly the same as we find in ordinary unconsciousness, or even in sleep when without dreams. As far as the mind is concerned, there is no conceivable difference. And does any reasonable man think of the future state as one which may be visited during a mere temporary suspension of consciousness? The only future state I ever heard of is one which is entered by the soul when it has finally and irrevocably quitted the body.

A classical student, debarred reference to a higher authority, is tempted to point to Socrates, whose strong faith in the hereafter is better evidence than a hundred arguments like Mr. Thorne's. But if your correspondent wishes for true science, let him turn to a book to whose high character you, sir, have lately testified most emphatically—I mean Mr. Drummond's "Natural Law in the Spiritual World." He will find there the question dealt with from a strictly scientific standpoint, and if it does not convince him, I think you will have judged him more severely than I should venture to do here.

I most cordially agree with you, sir, as to the necessity of excluding theology from your pages. But perhaps you will permit me to remind your readers of the advantage it gives to the "heterodox" side—I object to the term, but use it for shortness' sake. The attack can be made with purely scientific weapons. The full force of the defence can only be felt when arguments are admitted from a wider sphere. If this be remembered, I object to nothing that science has to say. For myself I like to think of theology and science as separated by a very vague dividing line. I have not "discarded" either of them, and never shall. On the contrary, I feel more and more the power of a scientific theology and a theological science. And it was this cause that I was so grateful to you for advancing in your review of the book I have referred to.

J. H. Moulton.

King's College Cambridge, Oct. 3, 1884.

[1443]—Surely a complete answer to your correspondent, Mr. Selwyn Thorne, is to be found in the fact that his "victim" of drowning was not dead. Had he been so he could not have been interviewed as a living man by Mr. Thorne some days after, unless by a miracle. Death is the separation of the soul from the body, and here it is clear no such separation had taken place. The "victim" could not have been really bereft of breath, although he may have been of motion, and his mental and physical faculties (save that of breathing) totally suspended. But how does this state differ from that of a person in a trance, or even in sleep? and yet we do not expect these on awaking to bring us news of the next world.

F. C. N.

["Reductio ad Absurdum," "W.," "P. J. L.," "Edwd. B. Morton," "T. W.," "Chas. E. Strong," "Naturalist," and many others, substantially reiterate "F. C. N.'s" argument, in language more or less varied. "Naturalist" suggests the fluidity of the blood as a test of vitality, and alleges that if the drowned man's hand had been held so that sunlight or candlelight shone through it, a ruddy glow would have been seen, showing that the blood remained fluid in the vessels.—Ed.]

BRAIN POWER.

[1444]—I send you a suggestion, which you may not think altogether unworthy of your consideration. May not great mental power arise from the harmony that exists between the several parts of, rather than from the size and weight of, the brain? Phrenologists assign different functions to different parts of the brain. Let 7 represent the maximum development of any of the parts of the brain. Would not a man, all the parts of whose brain marked 5, produce greater effect, be a greater genius, in fact, than the man whose brain had 3 parts each equal to 7, but all the rest varying from 1 to 4? If there is any truth in my suggestion, then a woman's brain, though lighter than that of a man, might, under proper cultivation, owing to the greater harmony of its parts, produce as high intellectual effects as those now produced by men. Up to this time men have shown their superiority in every department of mental effort. The best poem, the best statue, the best picture, the best history, the best musical composition, the best of every mental production, has come from the brain of a man. But woman has not had the same care bestowed upon the development of her brain as man has had. What public school or college in olden time was ever endowed for her benefit? There may be in woman's brain such potential powers that, hereafter, she may produce, alternately with man—when, through several generations, she has received the instruction that man has received—the best of every mental work. May it not be the harmony of the parts and not the size of the brain that produces intellectual greatness?

W. H. Jones.

THE INFLUENCE OF MOONLIGHT.

[1445]—A friend of mine, who has resided many years in China, told me the other day, as an article of his belief, that sleeping in the moonlight in the tropics is most dangerous, as it leads to blindness or to the face being "drawn" permanently into strange shapes. He also added that mackerel, among other food, becomes perfectly putrid in one night if exposed to the moonlight. He believed this entirely! and added that a friend of his had his face permanently disfigured by so sleeping on the deck of a ship. To me the statement was as novel as it was amusing; but I did not care to combat it, as I was without information on the subject. Moreover, I saw plainly that any attempt to shake his faith would be useless. But I since find that the idea is generally known, and often believed in; and therefore ask you whether you could devote a short article to exposing the origin of the myth, for apparently there must be some accidents or incidents that have given rise and a colourable support to the theory. If you do not think it of sufficient importance or interest for an article, perhaps you would kindly say where I shall find any reference to the matter.

Littleton Hay.

Balhousie, Southbrook-road, Lee, Kent,
Sept. 14, 1884.

[The idea that moonlight causes putrefaction is as old as Pliny and Plutarch; and is, as our correspondent asserts, very common in tropical climates. My own impression is that the evil effects attributed to moonlight have their origin in exposure to the *clear sky*, under which radiation takes place rapidly, and dew is copiously deposited. Moisture in conjunction with heat is a most fertile agent in decomposition, and I suspect that the mackerel would go bad just as rapidly on a clear starlight night as they would when the moon is above the horizon. There may, however, be some other explanation of the effects produced on the human system, and I insert Mr. Hay's letter in the hope of eliciting it. —Ed.]

FERTILIZATION OF BEANS.

[1446]—"Bean" is a very indefinite word. Will "E. W." kindly inform me on what particular sort—French bean, scarlet runner, broad bean, &c.—his observations have been made, and I will do my best to investigate the matter. But it will want another season now, in all probability.

Grant Allen.

HARE-LIP.

[1447]—To what is a hare-lip a reversion? and in what degree is it hereditary?

E. W. A.

TEA AND COFFEE.

[1448]—Mr. Carus-Wilson's letter with this heading in your number for September 19 is doubtless valuable as giving his own experience, and detecting a source of evil not yet acknowledged by public opinion.

Let me say, in support of this view, that twice in my life it has happened that neither tea nor coffee passed my lips during a space of several months, and upon my resumption of tea, though I had made it weak, and drank it early in the afternoon, I was kept awake for several hours at night.

But before we can accept Mr. Carus-Wilson's theorem as proved, he ought to tell us how his tea was made. I mean, what length of time usually elapsed between the boiling water meeting the tea-leaves and the pouring out from the teapot into his cup? I have

good reason for this question, founded likewise upon my own experience. This I will state, with your permission, when we have received his reply. D. A. Beaufort.

FUNGOID GROWTH FROM DEAD FLY.

[1449]—I should like an explanation of the following. I found a fly on its back, dead. In a circle around it were a multitude of spores (?). It seemed as if this appearance of dust had been shot out of its body. I enclose drawing same size. I have before seen flies with fungus growing over them, but this is different. The fly appears free from the dust that is all around it. It recalled to my mind a description of a small-pox patient "shooting out deadly spores in all directions." St. John.

[The drawing simply represents a fly surrounded by a circle of dust of approximately five times the fly's length in radius. The dust is thicker laterally, and it is in the direction of the axis of the insect's body.]

VACCINATION.

[1450]—I am one of a family of twelve, of whom ten were born before 1802, and inoculated as was then the prevailing custom. I was born in 1804, and my father was induced to have me vaccinated. But in consequence of my suffering severely from glandular swellings in the neck, when the twelfth child, a son, was born, he was inoculated. Now, of all these children, I alone had the small-pox, when I was about twenty-five years old; and this I caught from a neighbouring clergyman, who, *N.B.*, had been carefully vaccinated by an eminent London surgeon, Sir A. Cooper, his uncle.

N.B.—Within the next four years two other clergymen in Hemel Hempsted had the small-pox. Both had been duly vaccinated, and both suffered notably. F. S.

LETTERS RECEIVED AND SHORT ANSWERS.

Thos. Radmore. As the eclipse was simply caused by the passage of the moon through the earth's shadow, you will, I think, see that neither the "fore" nor "afterglow" can be referred to it in any way. Thanks for P.S.—E. C. Chapman. Certainly *not*. Facts right enough, the rest rubbish.—John Hampden. My dear sir! Do not excite yourself so needlessly; and use such strong—not to say libellous—language.—W. F. Curtis sends a long account of a child five or six years old, whose skull was so frightfully fractured by the kick of a horse that the brain actually oozed over his face and neck. Given up by the doctor as fatally injured, the clergyman of the parish baptised the boy (that rite never having been previously administered), supposing him to be *in articulo mortis*. The sprinkling of the water, however, so far revived him as to cause the facial muscles to twitch; whereon he was taken to the Coventry Hospital, and eventually recovered. My correspondent forwards this apropos of the question of "Two Brains" (p. 229), but the connection appears to me somewhat remote.—W. Waring. A matter with which the Editor has nothing to do. You should advertise them.—Dr. Davey. It may or may not be that the functions of the brain are susceptible of localisation, but certainly all modern research goes to negative the mapping out of the cerebrum into areas of the size of a shilling or a florin, as in the system of Gall and Spurzheim. In the case of the cerebellum they were demonstrably wrong, and "mesmeric" experiments count for nothing, on the hypothesis that the mesmeriser influences the mind of the mesmerisee; since, if the former possesses the power claimed for him over the mind of the latter, and *believes* that he is touching (say) the organ of "acquisitiveness," his patient ought to feel himself "acquisitive" straightway. I do not know the address of the gentleman whose name you put on your pamphlet.—H. D. Hinde. I cannot remember whether Kant's "General History of Nature and Theory of the Heavens" has been translated into English, and am very far from books of reference where I write. Look at a list of "Bohn's Libraries" if you can.—F. W. Halfpenny. I fancy that the plant which cures the bite of the rattlesnake has its origin in novelists' licence. Perhaps some toxicologist, though, can say if there is any truth in the notion. — Dr. Wilson. I do not think that the barely conceivable possibility is denied (granting, of course, a sufficient number of millions of years). It is the reasonable probability that has to be shown. If your paper does that, and is not too long, I will do as you suggest.—G. I cannot say, off-hand, how far tidal influence is felt above London Bridge. Locks, &c., must complicate the matter.—W. Cave Thomas. Any letter within reasonable limits, explaining your views, will be inserted. You must not, however, expect to escape criticism. I fail to understand what you mean by colour not being "attributed to the ether waves." I always fancied myself that the sensation of colour had its origin in the variation in the length and frequency of the waves impinging on the retina. —E. S. Phillips. Yet another solution of Mr. Sedden's problem.—Piccolo asks if Mr. Mattieu Williams classes cocoa among stimulants?—F. Heeley sends me some remarkably economical outline maps for filling in by students of geography. As they are seemingly executed by one of the "graph" processes, they are, of course, very much cheaper than any engraved ones.—Frank H. Grierson thinks that *spectral* analysis, as applied to the *heavenly bodies*, must be a work of spirit!—G. R. Griffith. Will be noticed in due course.—Miss Stuart. The price of Knowledge was raised to threepence per copy on March 7, 1884. See concluding paragraph (in capital letters) at the head of correspondence column.—J. H. D. Is not your contention just open to the charge of logomachy?—Robert McMillan. I acknowledged the receipt of your letter when it reached me; but, up to this present writing, "Professor" Manville's paper has never turned up at all.—An Original Subscriber. The effect to which you refer would probably co-operate with that described in producing the effect of concavity.—Excelsior. You will see that "F.R.A.S." does furnish an Ephemeris of Wolf's comet this week on p. 303. Of what earthly use would it be for him to occupy space by the mention of comets visible only in very large telescopes as small, dim nebulæ, of which a 3-inch telescope would show no trace whatever?—A. E. Conte. Forwarded to publishers, who deal with such matters, with which the editor has nothing to do.—John Towers. I was really interested by your letter and its enclosure. The young astronomer has no reason to be ashamed of his work. Floreat semper.—Amy Newland.—If you intend to devote yourself to the observation and measurement, &c., of double stars, obtain the largest refractor you can afford. If, on the other hand, you propose to study solar, lunar, and planetary detail, star clusters, nebulæ, &c., by all means purchase a reflector. Aperture for aperture, reflecting telescopes are *very* much cheaper than achromatics, and, for studying the heavens generally, you get so much more for your money.—J. Elgis. Far away from a single book of reference, I can answer you but vaguely. (1) The method of measurement is too uncertain for us to predicate definitely which star is approaching us the most rapidly. Besides (as in the case of Sirius) recession may be converted into approach—and *vice versâ*. (2) The glorious cluster to which you refer, is 33 (Herschel) Persei; it is commonly known as "The sword-handle of Perseus." (3) No large meteoric stones have recently fallen in England. (4) On November 13 (after midnight), and again on the 27th.—Alpha. Your telescope is not sufficiently powerful to show Saturn. At best it could only exhibit him as a misshapen star. He is a little to the left and above ζ Tauri, and is so much brighter and more conspicuous than that star as to be unmistakable. Midnight is none too late to observe Saturn now; in fact, he does not south until between four and five o'clock in the morning. Ball's "Astronomy," published by Longmans, is excellent. For books on special departments of astronomy by the conductor of this journal, see Messrs. Longmans' announcement in our advertising columns. —Roland Ellis. The axis of the earth's shadow lies in the plane of the ecliptic to which the moon's path (from right to left across the face of the sky) is inclined. She was travelling, as it were, *downwards*—as well as from west to east—on Saturday night: hence the seeming direction taken by the shadow across his surface. It is the refraction of the sun's rays through our atmosphere which bends them into the shadow cone and dimly lights the moon's surface. Were that atmosphere removed, she would wholly disappear in a total eclipse.—Maximilian Strong. The date of the birth of Our Lord is not known with absolute certainty. I am unaware of any calculations of Sir Isaac Newton's having reference to this point. I will look up the question of Tiberius Cæsar on my return to England. You will see that the figure puzzle has been solved by a very large number of subscribers.—W. Had your solution of the figure puzzle arrived earlier it would have been inserted. I have had reams almost of answers, which I have had perforce to suppress. "Coincidences" possess a certain amount of value in a mathematical point of view, and, undoubtedly, they seem to interest a multitude of readers.

Forestry having changed hands, Mr. Francis George Heath has retired from the editorship.

A new small motor actuated by explosion of small charges of gun cotton has been made by Mr. E. Sturge, and is said to be applicable wherever small powers are required.

The Russian Customs Department has issued an order, dated Sept. 3, 1884, that goods bearing trade marks with effigies of the Holy Virgin, Saint George, or other saints, will not be admitted into the Russian Empire.

Our Whist Column.

SIR,—The illustration given by "Five of Clubs" in KNOWLEDGE of Sept. 12 appears to me unsound, for *Y must* make two tricks if he does *not* discard his winning Spade, but plays what is manifestly the proper card, *i.e.*, the Club three, keeping the Heart five, so as not to have to lead up to the tenace in Clubs. Thus :—

Trick 1.—*A* leads Diamonds—Queen; *Y* plays Club three. Won by *A*.

Trick 2.—*A* leads Spade. Won by *Y*, with Queen. *B* plays Club two.

Trick 3.—*Y* leads Heart five. Won by *B*, with Queen.

Trick 4.—*B* must lead a Club, and *Y* must make his Knave.

If, at trick 2, *A* leads his Heart, *Y* must still make his Club Knave and Spade Queen.—I am, sir, &c., KONGE.

UNSCIENTIFIC AMERICAN WHIST.

WHEN I wrote in *Longman's Magazine* an article on the science of the game of Poker—which may be called a thoroughly American game—many journalists in America expressed their doubts whether I should not be altogether beaten at the game itself by men who know nothing of the scientific principles which are really involved in the game. I think this not unlikely, considering that I have never taken a hand at the game—to which I may add that I am never likely to do so, the game being a purely gambling one, and gambling, in my opinion, is a degrading practice for any above the condition of the savage. But, during my recent stay in America, I have had occasion to play pretty frequently at the more scientific game—Whist, and I have been led to notice certain peculiarities in the way in which Americans play this game (growing gradually in favour among them) which shows that they have still much to learn. Of course nothing of what I am about to say is intended to apply to those Americans who know and appreciate what may be called the European method of playing Whist; only to those, ninety-nine I think out of a hundred, who regard themselves as good Whist players, but are not acquainted with—or despise—the conventional language of the game.

I note, first, that Americans very sensibly object to the part which honours play in Whist at home. The utmost they will allow honours to count is one-half our estimate. That is to say, if two partners hold three honours out of the four, they count "one" only instead of "two"; if they hold all four they count "two" instead of "four." But most Americans prefer to count nothing for honours. In one sense this is good, for it makes more depend on skill, and Whist is a game of skill; in another sense, however, it rather injures the game, because it eliminates those pretty positions which frequently arise where the saving of a game or of a point depends on making a certain number of tricks, counting before honours, already declared against you. Looking keenly out for the honours, or indications of their position, a good player sees that such and such tricks must be made to save the game, and plays entirely to make them, entirely changing his tactics perhaps for the purpose.

Again, Americans prefer long Whist to short, and here again the game loses certain points of great interest, arising when the play depends on details of the score.

But the chief point which is noticeable in American Whist play is that which Deschapelles (far and away the greatest Whist player ever known) called the most detestable fault a Whist-player can have: Americans at Whist are inveterate "players of their own hand." They will not admit, or cannot see, the advantage (in nine cases out of ten) of that system by which each player regards his own hand and his partner's as one—a system by which the game is made really scientific. For this system the general rule holds that it is better to inform your partner than to deceive the enemy. The American who considers himself strong at Whist adopts, instead, the principle that it is best to play a dark game. He reasons that by playing dark he hides his own hand from the adversaries, while, if they play the open game, he knows something about their hands—a manifest advantage, if his unfortunate partner had no part to play. But as the partner is equally deceived, and so far from helping is like to obstruct, the mischief much outbalances the advantage of the dark game. This I had known theoretically long since. But never till I played Whist in America did I have such clear proof of the fact as I have recently had. I have played repeatedly with a partner who knows the Whist language, against two partners, each of whom plays his own hand with considerable skill. Repeatedly I have been perplexed by the play of one or other of the adversaries, and occasionally I have seen that they have been able to make use to their advantage of those indications by which I and my partner indicate the cards we hold in particular suits. But I have satisfied myself that at least one trick in ten is gained in the long run (by which I mean that ten tricks are made for nine) by playing the open game, the two partners working together against two adversaries working separately.

Among the methods of play arising from this one-hand (or my-own-hand) system, is the practice of leading from a short-suit or a singleton, if no suit has much strength. This Americans do quite irrespectively of the question whether they hold few or many trumps. It is bad enough to lead thus, even when you hold only two or three trumps; but to lead from a singleton or a two-card suit, when you hold four trumps, is surely a Whist atrocity of the first magnitude. You get your anxiously-desired ruff, and presently find that your partner has a fine suit which only needed that fourth trump of yours to be brought in: instead, however, the enemy lead trumps, get the command in them owing to your cleverness, bring in their good suits, and make a great game. To which must be added that while, by leading from a very short suit, you fail to tell your partner which is your long suit, you quickly disclose to the whole table which is your weak suit: you omit to give your partner the only kind of information which, as a rule, can really be of use to him, and give the enemy just that kind of information which is most useful to them. For, as double dummy shows, there is no information at Whist more useful than that which tells where the weak suits of the enemy lie.

It will be understood that Americans like to play a ruffing game, and are in their glory when they get a cross-ruff. (In fact the only excuse for leading from a singleton is the chance of establishing a cross-ruff.) I roused intense wrath in an American partner when, after he had established a cross-ruff, I broke it by leading trumps. I had five, and a strong suit which had been established; he had led me a suit which I had been obliged to trump, and I could have led him twice from a suit he could ruff. We should thus have made by the cross-ruff five tricks, but no more, and two of these would have been sure ones anyhow. But of course I played no such game. I led trumps to stop the cross-ruff; got out all the trumps (making three tricks in that suit besides the two ruffs), brought in my strong suit, making three tricks in that—or eight instead of five. Yet he never ceased to rebuke me for stopping a cross-ruff which would have ruined us.—*Newcastle Weekly Chronicle.*

ONE of the most attractive objects at the Nice Exhibition is said to be a Chinese clock, which is stated only to date back to 800 B.C.

A DESPATCH from Washington recently stated that an Australian syndicate proposes to lay a cable from Brisbane, Australia, to San Francisco, and that the Government of the Hawaiian Islands will probably grant a subsidy towards the enterprise, amounting to £4,000 per annum for fifteen years.

INCANDESCENT electric lamps are being used to show how things are getting on in a temperature of 600° Fah., in Messrs. Perkins & Sons' bakers' oven at the Healtheries. The oven door contains a sheet of plate glass, through which the whole of the oven is distinctly visible.

A RED SOLAR HALO.—M. Forel, a French *savant*, has observed a remarkable reddish halo round the sun from a position in the Bernese Alps on August 26. At an altitude of 1,000 mètres the phenomenon was visible, at 1,500 mètres it was quite distinct, and at 3,000 mètres it appeared of striking splendour. The effect was repeatedly seen by M. Forel about this time and at different places in Switzerland, such as Grimsel, Innert-kirchet, and the Glacier du Rhône. The phenomenon was also observed in July by M. Forel at Saas-Fée at an altitude of 1,800 mètres; and he does not hesitate to affirm that during the months of July and August last a red halo or corona surrounded the sun, which, though difficult to see at low altitudes, became quite brilliant at 2,000 mètres above the sea. It would be well if aëronauts would keep a look-out for this phenomenon.—*Engineering.*

PURCHASED TITLES.—M. Jules Claretie, in the *Temps*, exposes the operations of an Italian agency that offers to supply titles of every degree of nobility for a fixed sum. The circulars of this novel bureau are usually addressed to bankers and flourishing financial agents in every part of Europe. The informant has become possessed of one of the missives, which is couched as follows:—"Sir,—Knowing the high position you justly hold in the financial world, and wishing you to profit by the same, either in the interests of your business or those of your family, through resources of nobility, I have the honour to inform you that I can, against an amount officially fixed, obtain for you either certain decorations or a title, which would doubtless facilitate the transactions which you have undertaken. Title of prince, 75,000 francs; duke, 59,000 francs; count, 25,000 francs; baron, 20,000 francs. All warranted, and in good form. Trusting to the favour of an early answer,—I am, sir, &c."

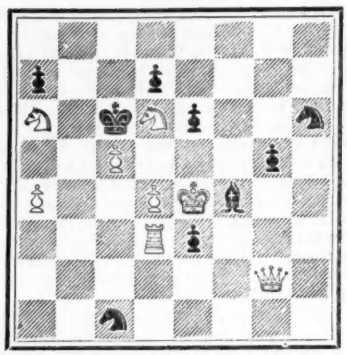
Our Chess Column.

By Mephisto.

PROBLEM No. 131.

(Selected.)

Black.



White.

White to play and mate in two moves.

A FEW CRITICISMS ON PROBLEM No. 130.

A most distracting problem.—F. J. D.

A very pretty problem, and very difficult.—G. W. Thompson.

Truly, as you say, a masterpiece.—H. A. N.

Certainly a masterpiece. I had some difficulty in not believing that 1. Q to Kt2 was the actual move.—W. Furnival.

SOLUTIONS.

Problem 129, by J. G., p. 248.

Position.

White (7 pieces).—K, QKt8. Q, KR8. B, KB8. Kts, Q6 and QB2. Ps, K3 and QR4.

Black (12 pieces).—K, QB4. Q, KKt7. R, KKt3. Kt, Q sq. P's, QR3, QB3, 5, 6, K3, 4, KB3, and KKt4.

Solution.

1. Q to R sq., threatening, if Q × Kt, 2. Kt to B8 mate; or, if Q, R, or Kt moves, 2. Kt to K4 (ch) (K to Q4, Kt × QBP mate) K to Kt3. 3. Q to Kt sq. (ch), K to R4, Q to Kt4 mate.

1. Q × Q, or (*a*)
2. P to K4 (Threatening Kt to B8 mate)

If Q to Kt8 (ch), 3. Kt to Kt7 (double ch), K to Kt3. 4. B to B5 mate.

3. Kt to B8 (ch) Q × P
4. Kt to Kt6 (ch) mate.

(*a*) If 1. K to Kt3, 2. Kt × P mate; or if 1. K to Q4. 2. Kt to Kt4 (ch), K to B4. 3. Kt to B8 mate; or if

1. P to K5, or (*b*)
2. Kt to B7 (ch) K to Q4

If 2. K to Kt3. 3. Q to Kt sq. (ch), K to R4. 4. Q to Kt4 mate.

3. Kt to Kt4 Mate

(*b*) If 1. P to R4. 2. Kt to K4 (ch), K to Kt3. 3. Q to Kt sq. (ch), K to R3. 4. Kt to B5 mate, &c.

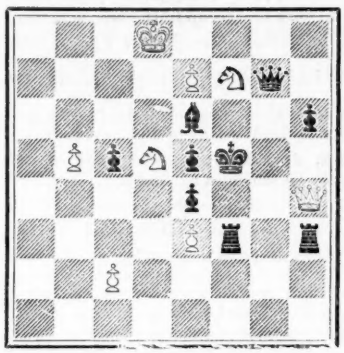
Problem No. 130, by E. N. Frankenstein, p. 268.

1. Kt to B4	R × Q, or	1.	P × Kt (*a*)
2. Kt to Q2 (ch)	K to Q5	2. Q to B6	P × P
3. Kt to K6 (ch)	mate	3. Kt × P	Mate
(*a*)			
1.	P to B7, or	1.	B to R2
2. B to Q5 (ch)	R × B	2. B × R (ch)	R × B
3. Q × R	Mate	3. Q × R	Mate

SPECIMEN OF OLD PROBLEM COMPOSITION.

Sir,—The enclosed problem was the invention of M. Calvi, of Paris. It was first introduced to the Chess Club of that capital as a problem of more than ordinary difficulty, and was not solved during the meeting. M. Alexandre, author of the "Encyclopædia of Chess," was the first to discover the solution, but this was not until the morning after the meeting of the club. It was first published in this country more than forty years ago. I send it to you in the hope it may prove sufficiently interesting to your "Chessists" for you to give it a diagram.

Black.



White.

1. Q × KP (ch)	1. K × Q
2. Kt to Q6 (ch)	1. K × Kt
3. P to B4 (ch)	3. K × Kt
4. P to K8	

Becoming Kt mate.

William Godden.

ANSWERS TO CORRESPONDENTS.

*** *Please address Chess Editor.*

Eugene Hamburger.—The Problem 130 is right enough, but we must apologise for mistake in answering "S. B. C." last week. If 1. Q to Kt2, then R to Q5 (a very fine defence), followed by R(K6) to Q6.

Scribbler (Chelsea).—If in No. 130, 1. Q to K4, Kt to Q3. 2. Kt to Kt5(ch), K to K4, and there is no mate. See above reply. Do you really expect any honest Christian to make out your signature?

Q. T. V.—See first reply.

A. E. R.—Received with thanks.

Correct solutions of Problem 130 received from M. T. Hooton, W. Furnival, H. A. N., Geo. W. Thompson.

Contents of No. 153.

	Page
Gambling, Show-Praying, and Lecturing at Sea. By R. A. Proctor	269
Pleasant Hours with the Microscope. (*Illus.*) By H. J. Slack	270
Dreams. IX. By E. Clodd	272
The Philadelphia International Electrical Exhibition	273
The Earth's Shape and Motions. (*Illus.*) By R. A. Proctor	274
Dickens's Story left Half Told. By Thomas Foster	276
International Health Exhibition. XVIII.	277
Optical Recreations. (*Illus.*) By F.R.A.S.	278
Grass of Parnassus. By Grant Allen	280
The Polytechnic. By W. Slingo	281
The Infinitely Great and the Infinitely Little. By R. A. Proctor	282
Editorial Gossip	283
Reviews	283
Total Eclipse of the Moon on October 4	284
Correspondence	285
Our Chess Column	288

NOTICES.

Part XXXV. (Sept., 1884), now ready, price 1s., post-free, 1s. 3d.

Volume V., comprising the numbers published from January to June, 1884, now ready, price 9s., including parcels postage, 9s. 6d.

Binding Cases for all the Volumes published are to be had, price 2s. each, including parcel postage, 2s. 3d.

Subscribers' numbers bound (including title, index, and case) for 3s. each Volume; including return journey per parcels post, 3s. 9d.

Remittances should in every case accompany parcels for binding.

TERMS OF SUBSCRIPTION.

The terms of Annual Subscription to the weekly numbers of Knowledge are as follows:—

	s.	d.
To any address in the United Kingdom	15	2
To the Continent, Australia, New Zealand, South Africa, & Canada	17	4
To the United States of America	$4.25 or 17	4
To the East Indies, China, &c (*viâ* Brindisi)	19	6

All subscriptions are payable in advance.

OFFICE: 74-76, GREAT QUEEN STREET, LONDON, W.C.

XUM